AMERICAN GAS JOURNAL

88th YEAR | OCTOBER 1946 | VOL. 165, NO. 4

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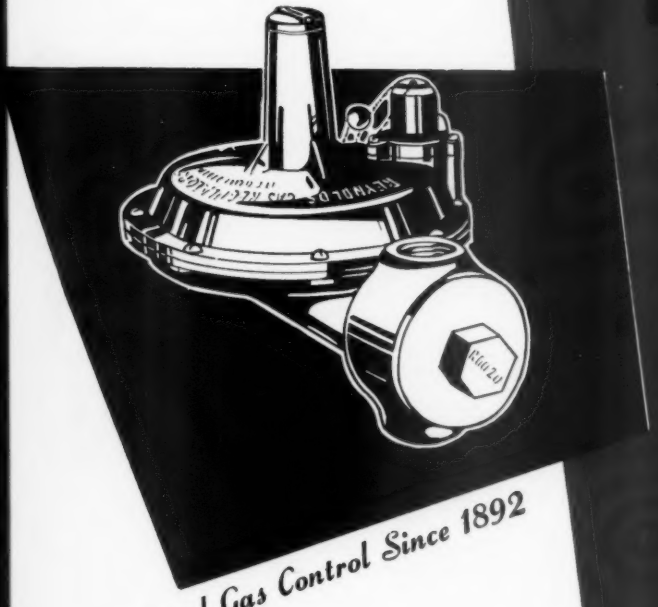
Efficient Gas Controls

REYNOLDS



Recognized Gas Control Since 1892

The modern gas control installation demands gas controls super-sensitive to each particular job. Reynolds Regulators meet these specific requirements and assure efficient operation.

Safety, accurate performance, years of service and economic upkeep — these are some of the built-in factors responsible for Reynolds continued superiority and leadership. Write us concerning any gas control problem — we are at your service.

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GAS REGULATOR COMPANY

ANDERSON, INDIANA

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Gas Consumers Service Insures Satisfied Users *of the* BLUE FLAME

WE offer the Gas Industry a personal check-up, geared to maintain a satisfactory service among commercial and industrial gas users.

Competent and experienced mechanics, specially trained for inspection service, make regular checking calls and adjustments of gas burning equipment.

Pressure regulation controls and thermostats are adjusted and inspected to maintain most efficient combustion at each burner. Emergency calls made at any time on request.

A full line of gas appliance repair parts and controls available in most cities where we operate.

Let us give you details of this service—a load builder and a load holder—now enjoyed by hundreds of gas companies and thousands of consumers.

Contact us at our booth No. 234 during the A. G. A. Convention.

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Gas Consumers Association, Established 1878

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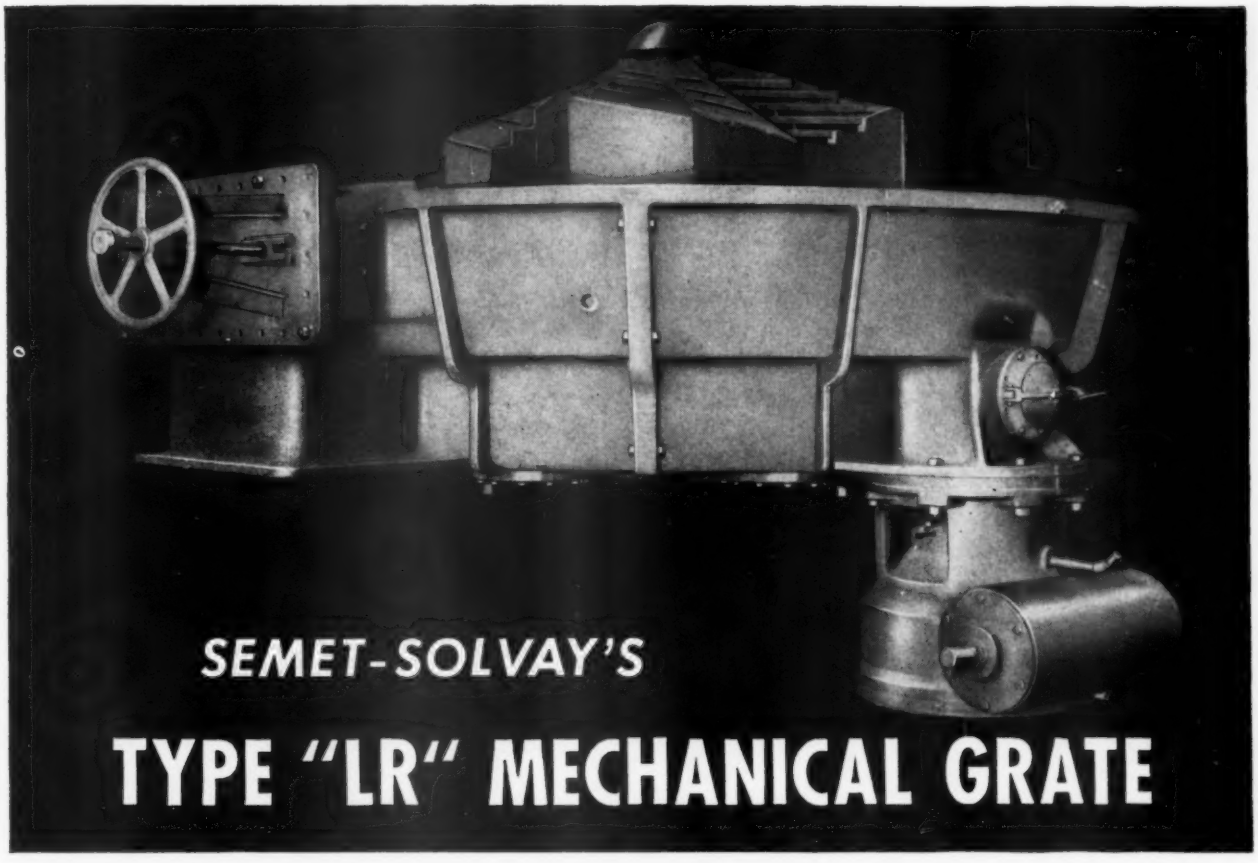

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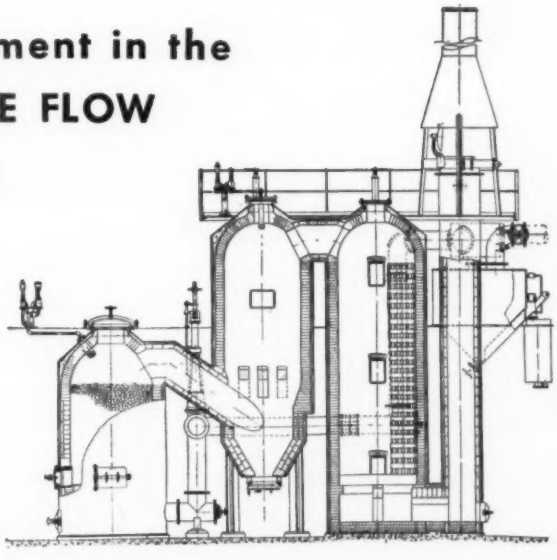
TYPE "LR" MECHANICAL GRATE

An Important Improvement in the
SEMET-SOLVAY REVERSE FLOW
WATER GAS MACHINE

- Agitation of fuel bed prevents formation of large clinker masses.
- Uniform removal of clinkers.
- Open fire bed gives improved steam economy.



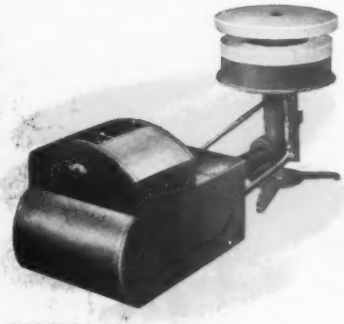
VISIT US AT BOOTH #708 · A. G. A. CONVENTION

SEMET-SOLVAY
ENGINEERING CORPORATION
40 RECTOR STREET NEW YORK 6, N.Y.

This is the GORDON BYDAND *Spreader-Flame* Line

which caused a sensation at the October show

For Home Heating . . .

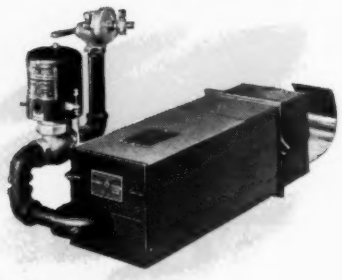


SERIES 84

Used to convert any round coal-burning furnace or boiler with grate diameter from 13″ to 36″ or any rectangular boiler with grate dimensions from 13″ to 45″. Three models, with capacities from 210,000 to 500,000 B.T.U. per hour.

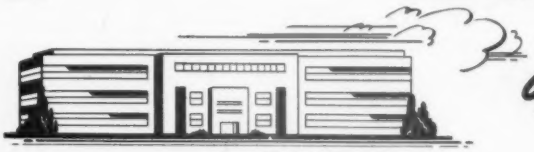
SERIES 302-20

Incorporates all of the outstanding Gordon features but also answers the need for a popular-priced line. Amazingly flexible in capacity—used from the smallest to the largest size of furnace or boiler, up to a capacity of 290,000 B.T.U. input.

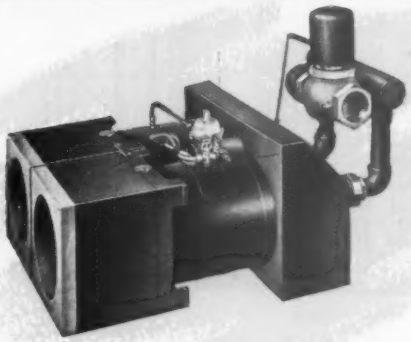


SERIES 400

For installations requiring or preferring the gun-type of burner. Can be used in any size or type of updraft boiler or furnace within its rating, whether round, square or rectangular. Capacities: 50,000 to 900,000 B.T.U.



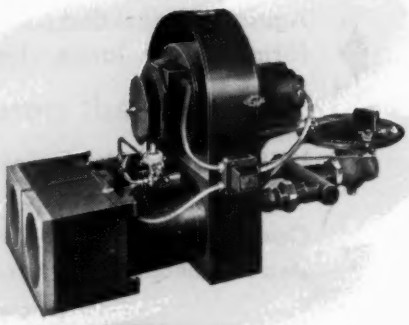
For Commercial Heating



NORDENSSON H

For apartments, factory and office buildings, schools, hospitals, theaters, etc. Atmospheric, luminous flame type; operates on gas pressures as low as 2″ W. G. using natural draft and with a minimum of noise. Easy to install.

GAS



NORDENSSON PH

A forced-draft companion to the Nordensson H type. Recommended for boilers and furnaces with down draft, insufficient draft or very limited combustion space or where gas consumption must compete successfully with the cost of other fuels.

ROBERTS-GORDON APPLIANCE CORP., 137 ARTHUR ST., BUFFALO 7, N. Y.

These are the GORDON Features . . .

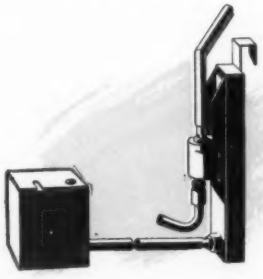
which make the line outstanding in the industry

THE SPREADER FLAME

featuring a secondary air seal, produces a mushroom flame which scrubs the entire furnace or boiler wall, insuring higher operating efficiencies.

THE TELESCOPING MIXER

allows the burner to be positioned accurately in furnaces or boilers having a wide variation in ashpit dimension. Contributes to inventory reduction.



THE AUTOMATIC PILOT

uses a simple, highly dependable principle of thermal expansion whereby the main gas valve operates only when the pilot is properly burning. Easy to service.

THE IRIS ORIFICE

This single orifice is adjustable to gas inputs ranging from 50 to 600 cu. ft. per hour. On a standard fixed orifice this would require 75 different sizes!

BURNS ANY KIND OF GAS

The Gordon burner is adjustable to manufactured, natural, mixed or butane-air gas with no major change of parts and without sacrificing operating efficiency. We estimate the saving, in change-over work, to be at least $15 per customer.

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ROBERTS-GORDON APPLIANCE CORP., 137 ARTHUR ST., BUFFALO 7, N. Y.

COLUMBIA SERVES . . .

A Great Part of the Country

The territory served by the Columbia System thrives on industry, commerce and agriculture. It is a *great* part of the country.

We believe firmly in its future.

And we are backing our belief by investing approximately $56,000,000 more—adding it to the $450,000,000 already invested in the plants and equipment of the System—to expand our facilities for service.

The $56,000,000 construction program has been started by the subsidiaries of the Columbia Gas & Electric Corporation. In a little more than two years, there will be added to the System:

More than 500 miles of new pipeline

Four new compressor stations

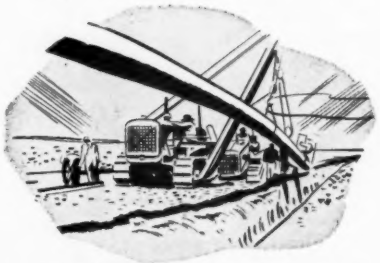
A new storage field and the enlargement of others

Nine new propane-air gas plants

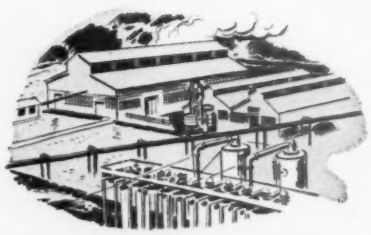
Approximately 1,000 new gas wells . . .

. . . to meet the growing requirements of homes, industries and commercial enterprises in the great area served by the Columbia System.

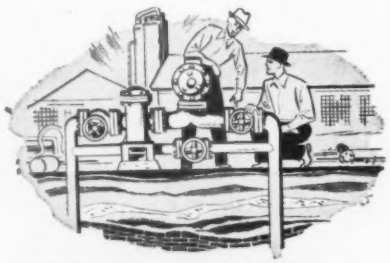
NEW GAS WELLS—More than 1,000 new wells will be drilled, seeking new supplies of gas in the Appalachian fields. Columbia now has more than 9,000 producing wells in this area.



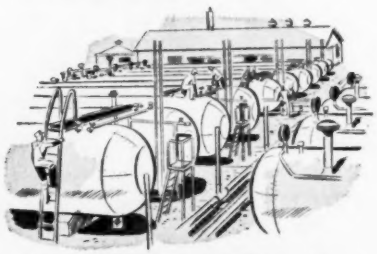
NEW PIPELINES—More than five hundred miles of large-size pipeline will be added to the System to facilitate the flow of more gas.



NEW COMPRESSOR STATIONS—Four new compressor stations, strategically placed, and additions to others. Compressors maintain the pressure behind the gas flame, help pump gas brought to Columbia from the rich Texas fields to augment supplies from fields in Ohio, Pennsylvania and West Virginia.



ADDITIONAL STORAGE AREA—An additional field will be opened for underground storage, and others enlarged. Columbia has stored 38 billion cubic feet of gas in several underground storage reservoirs. It draws on this supply to meet the winter demands and then refills the reservoirs during the summer.

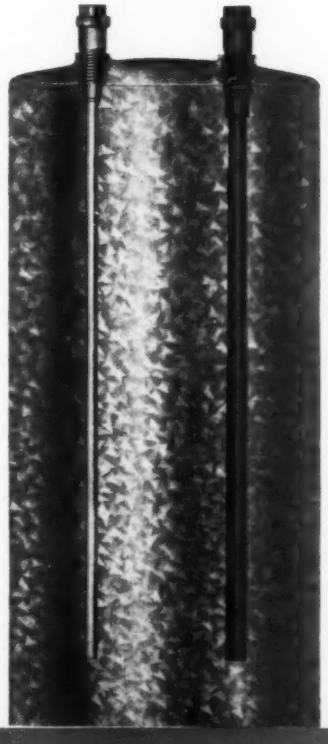


NEW RESERVE SUPPLY—Nine propane-air gas plants will be erected at advantageous points. They will be installed as a further aid in supplying cold weather demands. Propane-air gas may be interchanged with natural gas and has been employed extensively in this country to supplement natural gas supplies.

THE COLUMBIA GAS SYSTEM

PRACTICAL PROTECTION AGAINST RUST

For Galvanized Steel Range Boilers and All Types of Automatic Water Heater Storage Tanks



HERE'S A NEW AND EFFECTIVE PROMOTION TOOL for gaining more and better-satisfied Gas Water Heating customers. It's the "ELNO" Protector, a device which all hot water users have long needed and will soon be buying in tremendous numbers. Its appeal is irresistible once they hear and understand how simple and inexpensive it is to obtain "ELNO" protection against rust and corrosion in their equipment.

The "ELNO" Protector prolongs the useful life of the tank and eliminates the bug-a-boo of rusty hot water. Longer tank life means lower over-all expense to the consumer. Clean, rust-free hot water means greater satisfaction with gas hot water service. These facts can be used with terrific impact in your gas merchandising program.

1. The "ELNO" Protector is a RUST-PREVENTER, not just a rust remover or rust decolorizer.

2. It does its work by an electro-chemical process which prevents corrosion and thus eliminates the production of rusty hot water by galvanized steel tanks.

3. Its basic ingredient is "ELNO", a newly discovered special alloy.

4. It can be easily and quickly installed in a standard range boiler or any automatic heater.

5. The "ELNO" Protector is rodlike in shape, made in 1" and 7/8" diameters, and equipped with a special fitting which serves as a hot water outlet and permits connecting the Protector, tank, and hot water line into one rigid assembly.

6. The "ELNO" Protector requires no attention after being installed. There are no chemicals to add to the water. Its electro-chemical protective process is continuous.

7. With the "ELNO" installed, water may be heated above 150° F. without fear of excessive corrosion.

8. The "ELNO" Protector has a beneficial effect on soft and acid waters.

9. It can be installed to good advantage on existing water heating systems provided that corrosion is not too far advanced. In any event, it will appreciably lengthen the life of the tank. Should a new tank be required, the same "ELNO" Protector can be used.

PATENT APPLIED FOR

THE CLEVELAND HEATER CO.

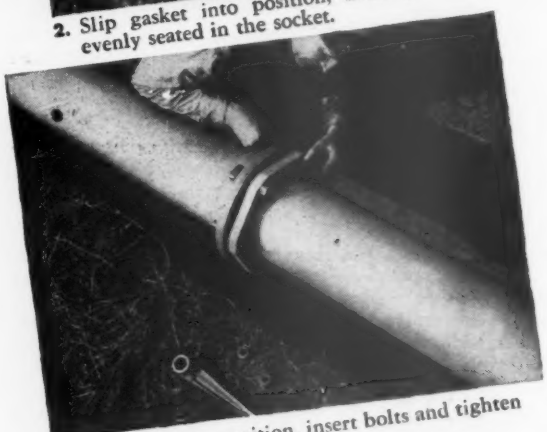
2310 Superior Ave. **Cleveland 14, Ohio**

No Expensive Special Tank Needed When the "Elno Protector" is Used

CLEAN RUST-FREE HOT WATER NOW ASSURED AT LOWEST EQUIPMENT COST

1. Brush socket, spigot and gasket with soapy water.

2. Slip gasket into position, making sure it is evenly seated in the socket.



3. With gland in position, insert bolts and tighten partially with fingers.

4. With ordinary ratchet wrench, tighten up bolts alternately (bottom bolt, then top bolt, and so on all around).

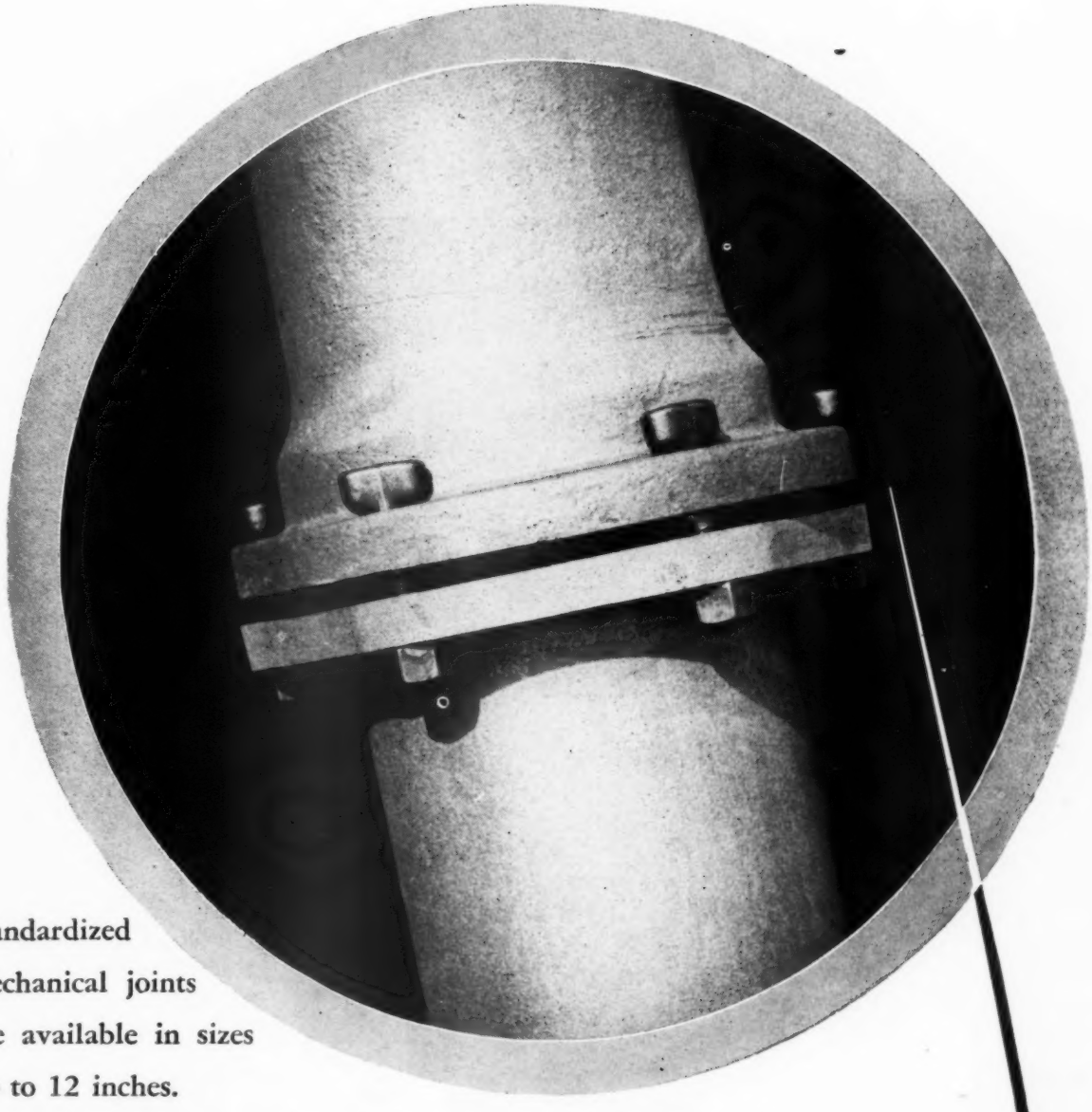
Completely Interchangeable

Here's what you get in the standardized mechanical joint. You get a bottle-tight joint incorporating the best design and performance features of the mechanical joints hitherto made by our members.

You get complete interchangeability of parts. Glands, gaskets and bolts are interchangeable no matter from which of our members you buy your pipe and fittings.

No longer need you stock parts for each make of pipe you buy—nor risk delay on the job through delivery of wrong parts to the crew.

Standardization adds the final touch of convenience and simplicity to mechanical joint cast iron pipe. Gas engineers who have sworn by it for years, now like it better than ever.



Standardized mechanical joints are available in sizes up to 12 inches.

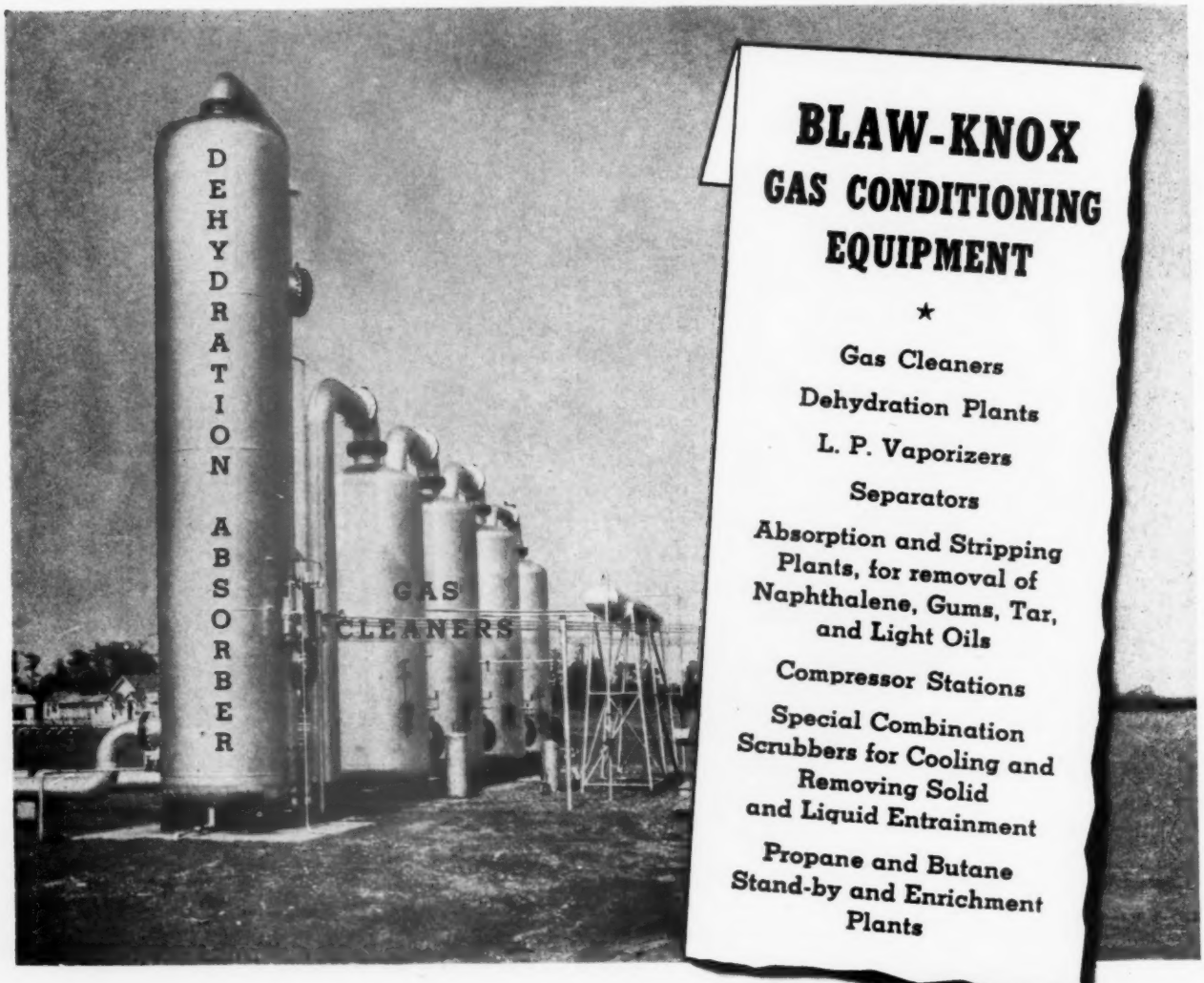
NOTE: Mechanical joint cast iron pipe is available in sizes up to 48 inches. Standardization of these larger sizes is being developed. Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engineer, Peoples Gas Bldg., Chicago 3, Ill.

CAST IRON

Standardized **MECHANICAL JOINT**

PIPE

A "NATURAL" FOR NATURAL GAS LINES



BLAW-KNOX GAS CONDITIONING EQUIPMENT

★

Gas Cleaners

Dehydration Plants

L. P. Vaporizers

Separators

Absorption and Stripping Plants, for removal of Naphthalene, Gums, Tar, and Light Oils

Compressor Stations

Special Combination Scrubbers for Cooling and Removing Solid and Liquid Entrainment

Propane and Butane Stand-by and Enrichment Plants

COMPLETE CONDITIONING COMBINATIONS GIVE PROTECTION TO NATURAL GAS COMPRESSOR STATIONS AND TRANSMISSION LINES

Blaw-Knox offers unit responsibility for design, fabrication, and erection of complete plants for natural and manufactured gas conditioning.

Ask for literature and complete information on Blaw-Knox Gas Conditioning Equipment.

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OF BLAW-KNOX COMPANY
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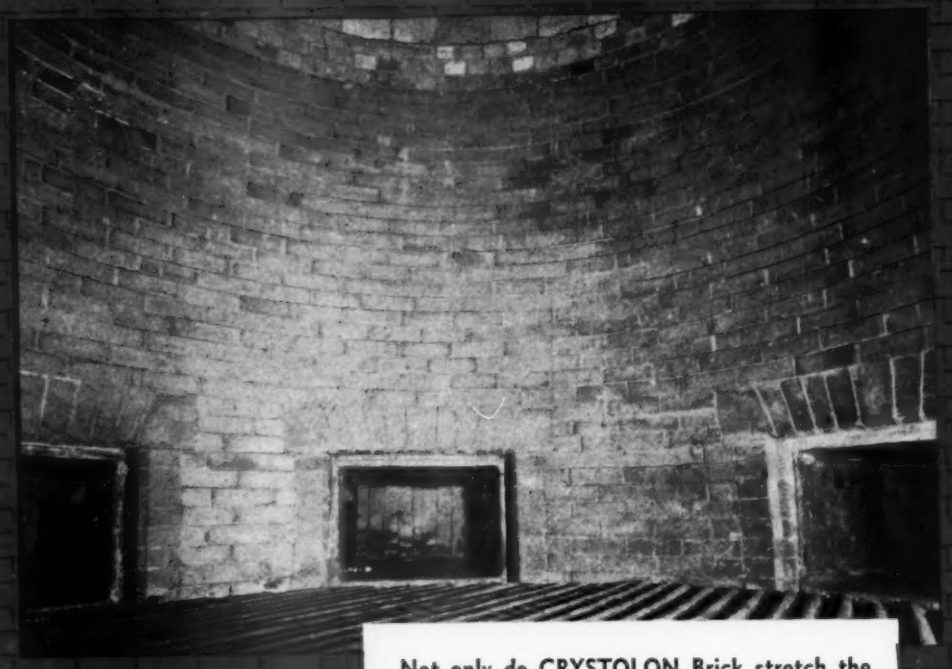
BLAW-KNOX GAS CONDITIONING EQUIPMENT

Crystolon Brick for LONG LINING LIFE!



Not only do CRYSTOLON Brick stretch the life of generator linings very considerably due to their refractoriness, chemical stability and resistance to the penetration of molten ash, but also these silicon carbide brick often pay for themselves the first year by savings in cleaning costs alone. Among water gas plants, in generator after generator, CRYSTOLON Brick are increasing lining life, reducing cleaning time. An important feature of CRYSTOLON Brick is that their dense, hard surface resists slag penetration and therefore the clinker ring is quickly broken free, leaving the surface of the lining clean and undamaged for further service.

NORTON COMPANY
WORCESTER 6, MASSACHUSETTS

Norton Refractories

EFFICIENCY Through the YEARS

That's GASAIR!

3 — 10MCFH GASAIRS still operating with precision after many years of satisfactory service

PEAK LOAD • STANDBY • 100% SERVICE

The PATENTED features of GASAIR insure completely automatic precision operation year after year. GASAIRS require a minimum of service and upkeep.

PROPANE • BUTANE *or* MIXTURES

GASAIR handles them with equal efficiency — assuring uniform BTU sendout — regardless of weather conditions.

If you are considering additional gas requirements — or changing to L P G 100% — get the facts about GASAIR — *Now!*

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INTERNATIONAL BLDG.
ROCKEFELLER CENTRE
630 5th AVENUE
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See the latest automatic Universal Gas Ranges in the complete display of all models at GAMA's exhibit in the Atlantic City Auditorium during the AGA convention, October 7 to 11, inclusive.

For the latest in the nation's outstanding ranges, come to Booth 417-18-19, right in front of the center of the stage.

It will be an exhibition worth while seeing—and, of course, we will be happy to renew old acquaintances and to make new friends.

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The Preferred Cooking Fuel

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The Preferred Gas Range

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OCTOBER
1946

AMERICAN
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VOLUME 165
No. 4

Liquefied Petroleum Gas

It's Future in the Gas Industry

By
Francis E. Drake
Chief Engineer
Pacific Gas Corporation,
New York, N. Y.

OUR GAS INDUSTRY, over a period of one hundred and sixty years, has advanced steadily, at times surmounting seemingly insurmountable obstacles. At no period has its path been other than thorny. The roughness of the way, however, has developed that resourcefulness and ruggedness, coupled with grit and determination which is so characteristic of the Gas Industry.

With the advent of the electric light the gas man was compelled to seek other outlets as well as cheaper processes or go out of business. Competition became keen. The hardy gas pioneer was equal to the challenge. He adopted new methods, (water gas patented by Thaddeus Lowe in 1872), perfected old manufacturing processes, developed a sales consciousness which inspired him to go out after and acquire volume business in quantities never before believed possible of attaining.

Liquefied Gases Appear on the Scene

This is where the gas industry found itself after the First World War when in the early 1920's liquified petroleum gases began to appear. Little was known or thought of them at that time although quite some use of the lighter hydrocarbons had been made previously by utilizing Benzol for enriching purposes but with only mediocre success.

The first official governmental tabulation of LP gas is for 1922 when there was used 223,000 gallons wholly and entirely distributed by means of bottles.

Gas Company Utilization

In 1928 the Gas Industry first showed its interest in LP gas by utilizing in its manufacturing processes 1,500,000 gallons out of a total sales of LP gas that year of 4,523,000 gallons.

The increase in the use of LP gas over the period 1928-1945 is then seen to be something as follows:

Total gallons increased	**243 times**
Domestic gallons increased	**208 times**
Industrial gallons increased	**700 times**
Mfg. gas gallons increased	**40 times**

Here is a perceptible increase in all lines except gas manufacture. Part of this, of course, is due to World War II and the restrictions imposed by the government in diverting, insofar as possible, all the butanes to synthetic rubber, gasoline blending, and industrial augmentation.

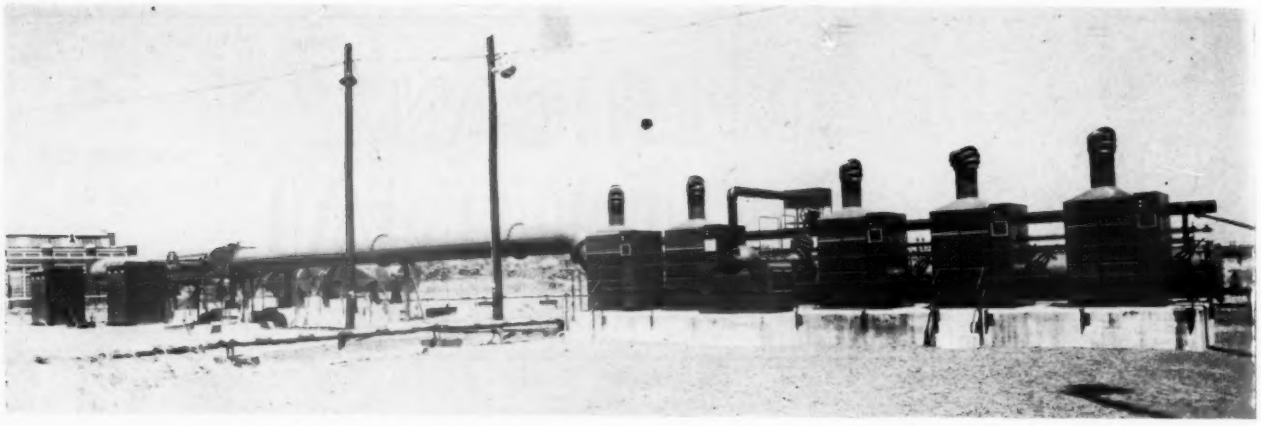
1946 and the years following give every indication of changing this trend. More and more gas companies have satisfied themselves as to the value of LP gas for not only peak load augmentation but for reforming and enriching. Experiments are going on today in many quarters to determine definitely the percentages of various LP gas-air mixtures that can be added to the present manufactured gas without upsetting domestic and industrial appliance adjustments. Much interesting and valuable information is being gathered which undoubtedly will be available to the industry in another year. Some investigators are finding that from 35-40% of propane-air gas can be added to their present gas without increasing either their BTU's or complaints. Eventually science will make it possible to substitute LP air gas with other gases of corresponding heating value.

*Year	Total Gallons	Domestic	Industrial & Miscellaneous	Gas Mfg.	Chemical Mfg.
1922	223,000	...	...	...	...
1928	4,523,000	2,600,000	400,000	1,500,000	...
1937	141,400,000	40,823,000	62,610,000	11,175,000	26,792,000
1945	1,100,000,000	540,000,000	280,000,000	60,000,000	220,000,000

** Excerpt, Liquefied Petroleum Gas Ass'n Bulletin, January 2, 1946.*

The gallonage as given compared to the entire output each year:

	1928	1937	1945
Domestic	**57.8%**	**28.9%**	**49.1%**
Industrial	**8.8%**	**44.3%**	**25.5%**
Gas Mfg.	**33.4%**	**7.9%**	**5.4%**
Chemical	....	**18.9%**	**20.0%**



Typical GASAIR plant for making propane-air as of any B.T.U. This plant has a capacity of 500 MCF/Hour-12,000 MCF per day.
Erected for the Consolidated Edison Company of New York, Inc., for use at their Hunts Point Plant.

Reforming

Reforming of liquefied petroleum has been going on for years, but a greatly revived interest has been aroused due to the desire for cheap additional peak load capacity. Some able technical articles have appeared on this subject of late, notably the ones by Mr. E. G. Boyer,* Manager, Gas Department of the Philadelphia Electric Company and the later one by Mr. H. M. Kopp, General Engineer, Connecticut Light and Power Co. The recent tests and experiments have corroborated the findings of some of the early pioneers, that from 20-30% of increased capacity can be obtained in a water gas set by reforming propane and butane.

Cold Enriching

This is the simplest problem of all but except in extreme cases gives the lowest tangible return. The value of cold enriching depends largely upon the relative costs of other raw materials as propane and butane. When a coal gas plant is in operation or water gas oil is high, stretching of those gases and enriching with LP can be done to advantage. This is particularly true when an oven plant is running with excess producer gas available. Why the oven plants supplying utilities have been so slow to adopt this method of extending their make, for the few days of peak required by house heating in the winter, is a mystery, Several are now installing LP-gas storage and vaporization and are going to be mightily surprised and pleased at the results obtained coupled with the low cost (investment plus gas) per MCF.

* American Gas Journal, *August and October, 1945 and July, 1946.—Ed.*

Underfiring Ovens

This, as has been pointed out before, is one other way to stretch the capacity for those days in the wintertime when necessary. A BTU for 100% underfiring is available with LP-gases all depending upon the make and type of oven installation. In underfiring with LP-gas no material change in setting is required to switch from one gas to the other. This then releases all the underfiring gas for sale.

Plant Capacity Increase

A gas plant equipped with proper LP-gas storage and prepared to take advantage of its many virtues can at a very low/M investment cost increase plant capacity up to 50% and in some instances more.

Plant Cost

Plant cost varies according to location, number of storage tanks installed, character of foundations required and number of vaporizing and mixing units desired.

The highest cost portion of any LP gas-air plant is, of course, the tank farm.

Tank Farm Capacity

In the early days a tank or two was all that was required for the LP refineries could keep cars rolling in daily if necessary. Not so today. Cars are few and far between and the problem is for the refiner to find cars and have enough storage at his plant to properly care for his customers' needs. It is much simpler, safer, and more economical for a gas plant to put in an additional storage tank or two than to be "fresh out" of LP gas the coldest day in the year when rail traffic is disrupted by ice and snow and the customers have all heating equipment going full blast.

A tank 30,000 water gallon capacity (25,000 propane gallons) will cost at the most under present day conditions and with normal foundations between 9 and $12,000 installed and connected up ready to go. I have seen figures quoted recently much lower than that, but I am fearful they were made with the past in mind and not present or future. Remember, a 30,000 water gallon propane tank is made of 15/16" to 1" steel, weighs about 40 net tons, and is from 60 to 70 feet long.

My advice to all contemplating the installation of LP gas plants, be they for 100% use or augmentation, is figure on tank farm capacity to carry you over the winter months peak whether it is for one or thirty days. When you have done that, then double the number of tanks and go ahead. I know of several companies that have figured on only 8-9 days peak in December and January each year. Their plants were started after the peak season was over and to date they have run several times many more hours than the number calcualted. That means that when the peak really does arrive tankage will be shy and winter deliveries are going to be problematical.

A company having ample storage facilities places itself in a most favorable position:—

1. It can purchase its winter supply during the months when the refiner's storage space is full.

2. By the above, as time goes on, the company will be able to take on distress shipments at a financial advantage to itself.

3. With ample storage space the refineries will vie with one another to be the supplier.

4. With ample storage the operator can enter the peak load season

with a calm mind and without fear and trembling.

5. With ample storage the utilities customers are sure that "The fires will not go out" and that they will have ample gas when, as, and if needed.

Distribution Augmentation

Up to the present I have touched only upon the plant and its operation. One other very important phase in many cases requires more attention than the plant. Often the plant capacity is sufficient, but a bottle-neck in the distribution system stymies the flow of gas to some important area. With LP gas automatically operated, a small tank and unit can be installed and that district augmented or converted entirely. Often it is cheaper to do the above than to rebuild the distribution system. Many natural gas companies do this because they have the favorable advantage of being able to convert 100% by only increasing their inflowing LP-gas by 1-200 BTU. A few BTU's are given away under those conditions, but it is far better thus, than to have "The fires go out." All of this district augmentation or supply can be handled entirely automatically, the machines taking up the load as the pressure goes off.

Therm Rates

In a paper I presented before the Natural Gas Division of the American Gas Association in Cincinnati, Ohio, last May I went into a rather lengthy discussion of Therm Rates, their advantage, etc.: I want to touch on them briefly again because I believe the time is ripe for a concerted effort on the part of the Gas Industry to sell the idea of therm rates to the various Public Service Commissions throughout the country.

Therm rates are in effect in some New York State schedules but only on a fixed BTU basis and with the equivalent MCF published along side of the therm. One thing we can do to hasten the day of the therm is for the inventive geniuses in the meter and calorimeter field to get together and work out a therm-gas meter which can be installed at the point of supply. This would then register in therms and cubic feet. The cubic feet on the customer's meter each month could then be multiplied by some constant as indicated by the average monthly reading of the master system input meter.

I know work has been done along the lines above but to my knowledge no such meter has been developed so that Public Service Commissions will approve. I have every reason to believe that if such a meter is developed the Public Service Commissions of the various States will one by one give their consent to its adoption. Its approval would permit of variable BTU's to fit any and all conditions of LP gas-air mixtures so that in many cases 100% substitution could be effected without loss to the company and as a distinct gain to the customer because they would then be assured of a supply when they needed it most.

100% Conversion to LP Gas

Since the close of hostilities the smaller, and some not so small, communities are many of them changing over to LP-gas, usually propane and of varying BTU's. A few stick to their old form so as to avoid going to the State Commission for approval of rate change. Others take the "bull by the horns" and go to a higher BTU. One company I know of is contemplating just doubling its BTU and rate. A higher than 525-540 BTU is preferable for several reasons:

1. A higher percentage of air is entrained with the lower BTU thus causing sharper flame and more ready flash back. This makes conversion of old appliances particularly difficult.

2 .With increased BTU a better flame characteristic is had which:

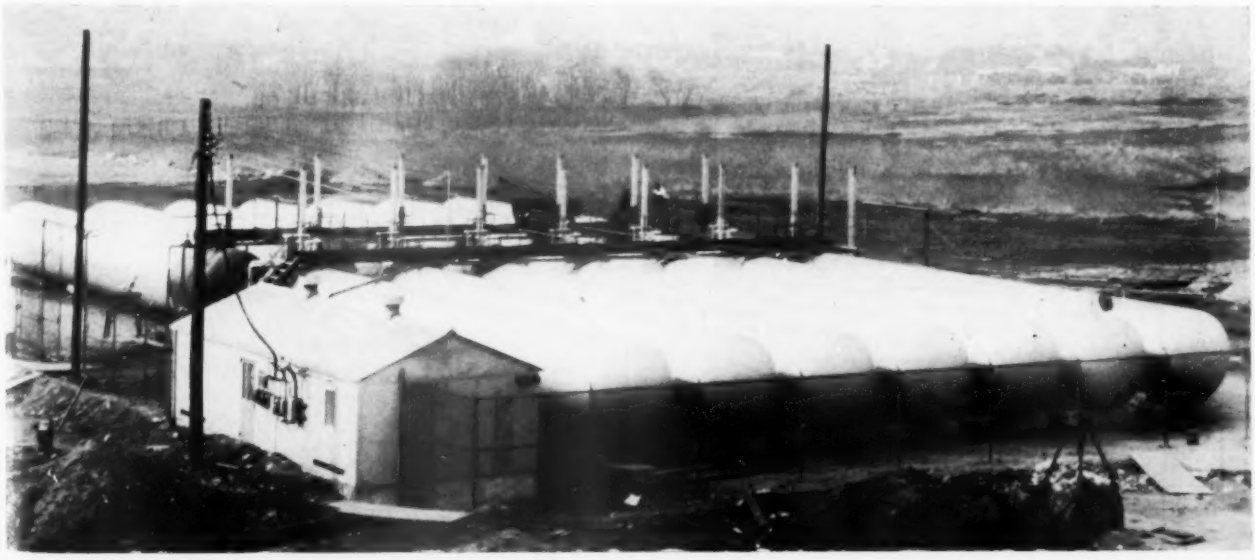
(a) Allows easier conversion of appliances;
(b) Increases main capacity in direct ratio to BTU increase;
(c) Allows lowering of main pressures in most instances which in turn decreases leakage.

One company with which I am conversant changed from 540 BTU coal gas to 900 BTU propane-air gas by just starting up the propane-air machine and putting it on the town 100%. For approximately two months no attempt at conversion was made other than to lower main pressure several inches of water and to instruct the customers to turn on gas only half way rather than on full.

There were no house heating units on this system and but few Servel units. Those had to be lighted each day until new burners were installed.

I do not recommend such procedure but it demonstrates what one can get away with by using a High BTU in the changeover gas.

Typical Propane Tank Farm, Capacity 350,000 Gallons Propane.



There is some propane-air gas BTU that can be substituted for most any and all gases. Frank Knoy's formula* will give you an inkling as to what that BTU may be, but the only safe way to definitely determine is to bring in one or more of each type of equipment on the lines, set them up at the plant, and then check actually with the predetermined BTU.

A.G.A. Statistics

A.G.A. in 1944 gave as 101 companies in the country which had gone to 100% LP-air gas. Today they tell me that 117 have now converted 100%. In supplementation of that figure there are to my personal knowledge 14 additional companies now under way to be changed over in the not far distant future.

Bottled Gas

The ordinary utilities operator considers "bottled gas" as definitely out of his line, but I disagree for a number of reasons:

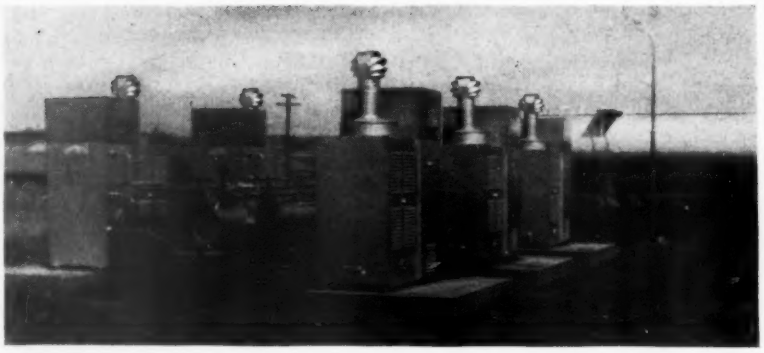
1. There are many prospective customers on the fringe of every community who want the convenience of gas, but the company just can't afford to make a main extension to take them on. Bottled gas will hold them and at the same time prevent their making a heavy investment in electric equipment which some day the gas company will regret.

2. Within a radius of 25 to 50 miles a gas company can afford to supply, and will make a good return, out of bottled gas. Some day these suburbanites may live on the gas mains and then they will not have to be unsold electrically.

3. For bottled gas a much higher rate can be charged than for a product delivered through the mains.

4. There is no commission control of bottled gas. A utility is on its own when in the bottled gas business. Many a small utility has pulled itself out of the "red" by going into this business. One small company I know of changed to propane-air. They had a total of 400 odd customers and went into the bottled gas business at the same time. The past year they tell me they added 1000 bottled gas customers. A few on the lines have also been added but their money is now being made out of bottled gas.

*See AMERICAN GAS JOURNAL, *December, 1945, page 12.—Ed.*



Installation of five 10,000 c.f.hr. units, 1600 B.T.U. butane-air at Camp Roberts Calif. in 1941, since converted to propane-air.

Advantages of LP-Gas over Electricity

1. With LP gas one has instant availability. No storms or line outages disrupt the service.

2. Flexibility of heat control is greater with LP gas than with electricity.

(a) Electric ranges, water heaters, etc.. have only a certain number of speeds or heats available, usually two to four.

(b) With an LP range or water heater the burner may be turned on full for the first rapid input and then reduced to a simmer as soon as water starts boiling or food cooking. This leads to a saving in time and fuel.

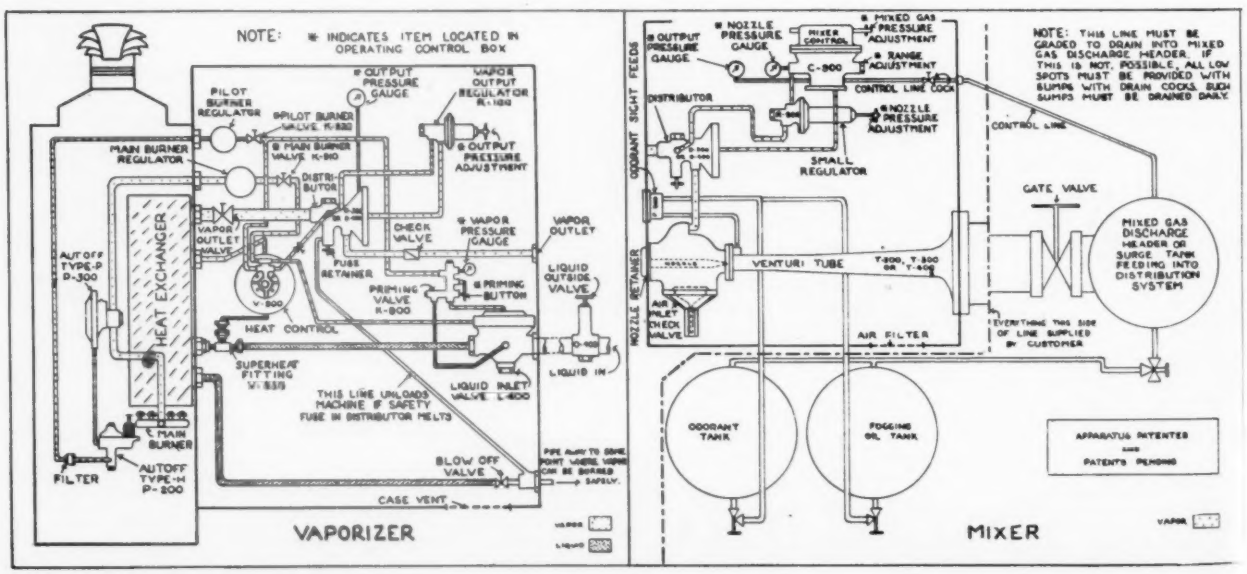
3. American Gas Association and U. S. Department of Commerce report as follows:

3.52 KWH = 1 pound of propane

With propane weighing 4.24 pounds to the gallon you may make your own comparison on the rates prevailing in your territory.

Propane will have to be very high in price or electricity extremely low to make the answer favorable to electricity.

(Concluded on page 78)



Flow diagram of "Gasair" vaporizer and mixer.

A Method of Testing Large-Capacity Gas Meters in the Field

By

Howard S. Bean[1], M. E. Benesh[2], Frank C. Witting[3]

PART 2

Methods of Conducting the Test

Displacement Test. As this test is usually made with air[4] the first step is to close the inlet and outlet valves, to seal the outlet line with a blank plate,[5], and to remove a short section of the inlet piping, or to otherwise open the meter inlet to the air. The testing equipment is then connected as shown by Fig. 1, with the small air blower connected to the outlet to draw air through the system. The meter is purged of the gas, first by manual rotation of the impellers and then by the small air blower to remove any gas remaining in the system. The location of the meter hand wheel is checked to see that it engages the proper impeller shaft so the driving system will rotate the meter in its normal operating direction. The driving system is coupled to and aligned with the hand wheel. The cam for operating the breather is loosened and rotated until its position bears the correct phase relationship to the meter inpellers and then locked in position.

The reference meter is set so as to be in a level position and its zero differential pressure gage is adjusted so that the oil bead is centered in the bowed tube. A water manometer is connected to measure the static pressure in this meter. The gears of the meter's driving system are set to operate the meter at a displacement rate equal to one percent or less of the rated capacity of the industrial meter to be tested. To bring the system into final adjustment for a test the cocks in the lines to the zero differential indicators of both the industrial and reference meters are closed, and the motors driving the industrial meter, the reference meter and the blower are started simultaneously.

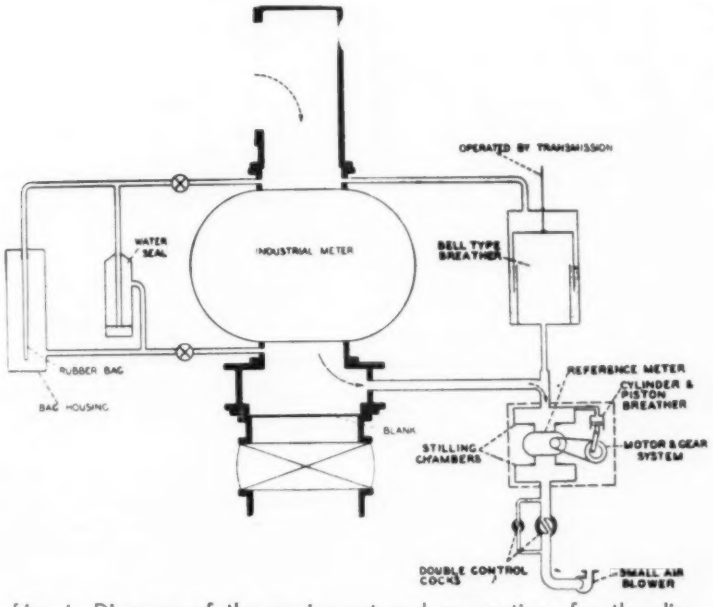


Fig. 1. Diagram of the equipment and connections for the displacement test of a rotary gas meter.

The flow of air through the reference meter is adjusted by placing the ⅜" cock in about mid-open position and adjusting the 2" cock until upon cracking the zero differential indicator cocks the oil bead remains near the mid position. The indicator cocks are then fully opened and zero differential pressure is maintained by constant manual adjustment of the ⅜" valve.

Next, the rate of rotation of the industrial meter is adjusted to correspond with the rate of flow through the reference meter. To do this, the cocks to this meter's differential indicator are cracked and by regulation of the speed of the driving motor the meter speed is adjusted until the rubber bag remains in a neutral position. The indicator cocks are then opened wide and the meter speed is further adjusted until the bag shows no definite tendency to swell or flatten. However, the bag will usually show a hunting or oscillating motion and this is reduced to a minimum by adjusting the amplitude of the mechanically operated breather.

While these adjustments are being made, as well as throughout the test, the brake installed on the industrial meter is set to maintain just enough braking force to eliminate all back lash between the meter gears, and to maintain a slight load on the driving motor.

Thermometers are placed in the inlet and outlet connections of the two meters, and the equipment is ready for test as soon as the inlet and outlet temperatures of each meter agree within ±1.5°F. The rest positions of the two zero differential pressure indicators are checked and a record

[1] Chief, Gas Measuring Instruments Section, National Bureau of Standards.
[2] Chief Research Engineer, People's Gas Light and Coke Company, Chicago, Ill.
[3] Research Engineer, People's Gas Light and Coke Company, Chicago, Ill.

[4] This test is not influenced by the gas composition. The line gas can be used where there is no difficulty in its disposal; however, the number of installations of this type are few.

[5] If a blank plate cannot be installed in the outlet line, the line between the meter and outlet valve should be sealed with water.

of the reading of the reference meter counter is made just before a test is started. The start of a test occurs as a mark on the industrial meter hand wheel passes some reference point and the reference meter counter is started at the same instant by the engagement of its clutch. While the test is in progress one operator regulates the speed of the industrial meter and another regulates the ⅜" cock so that zero differential pressure is maintained across each meter. A third observer reads the meter thermometers and inlet pressures every two minutes throughout the test, and keeps a record of the number of revolutions made by the industrial meter, either by direct count or by observation of the meter counter readings at the start and finish of a test, and measures the duration of a test with a stop watch.

The usual duration of a displacement test is from 15 to 20 minutes. It is concluded by disengaging the reference meter index as the mark on the industrial meter hand wheel again passes the reference point. The reference meter index reading is recorded, each observer is shifted to perform different duties, and a second test is made as soon as all conditions have been verified.

Upon completion of the second test the rest positions of the two zero differential pressure indicators are checked to be sure there has been no shift, and the results from the two tests are computed. These results by different observers should agree within (0.15%) and are computed by the equation:

$$d_i = \frac{d_r \quad N_r}{N_i} \times \frac{p_r \quad T_i}{p_i \quad T_r} \qquad (1)$$

in which

d (ft^3) = displacement per revolution

N = number of revolutions

p (in. Hg) = absolute pressure at meter inlet

T (in. F deg.) = mean of the average inlet and outlet absolute temperatures, i.e., observed temperatures

Where

subscript i = industrial meter under test

subscript r = reference meter

Table I shows the observed data and computed result from the displacement test of a 10" × 30" meter.

TABLE I

METER DISPLACEMENT TEST

Meter No. 11246 — Meter Size 10" x 30"

Location - Southport and Courtland — Date - Nov. 20, 1940

		Industrial Meter				Reference Meter			
Time Interval		Index Reading	Static Pres.	Temperatures Inlet	Outlet	Index Reading	Static Pres.	Temperatures Inlet	Outlet
1		2	3	4	5	6	7	8	9
Min	Sec	rev x 4	in. H_2O	°F	°F	rev x 1	in. H_2O	°F	°F
0	0	28265	0.0			53226.45	0.0		
1	0			51.9	50.7			53.7	54.5
3	0			51.9	50.8			53.5	54.5
5	0			52.0	50.8			53.3	54.5
7	0			52.0	50.8			53.1	54.3
9	0			51.9	50.8			53.0	54.2
11	0			51.9	50.9			52.9	54.1
13	0	28387		51.9	50.9			52.7	54.0
15	28		0.0			58412.81	0.0		
Revolutions		30.5				5186.36			
Averages			0.0	51.97	50.81		0.0	53.17	54.30
				51.39				53.74	
Absolute			29.59	509.39			29.59	511.74	

Reference Meter Displacement from Fig. 4 for 335 rpm, d_r, 0.024108 ft^3

Industrial Meter Displacement,

$$d_i = \frac{0.024108 \times 5186.36}{30.5} \times \frac{29.59}{29.59} \times \frac{509.39}{511.74} = 4.0806 \text{ ft}^3$$

Clearance Test. The purpose of this test is to determine the relation between the pressure drop across a meter and the rate of flow through the clearance spaces of the meter. This is done by developing a pressure difference across the impellers by mechanically driving the meter with the outlet closed. The gas that is thereby pumped into the closed outlet chamber by the rotation of the impellers returns to the inlet chamber through the clearance spaces.

Since the inner surface of a meter case is slightly uneven the width of the clearances between the impellers and case will vary for different angular positions of the impellers. Hence in trying to maintain a constant pressure difference across the impellers, it would be necessary to vary the rate of rotation throughout each revolution, going faster as the impellers pass a wide clearance space and slower as they pass the narrower spaces. This, however, would not give a true leakage-time relation because the time interval taken to pass a given arc of narrow clearance will be longer than that taken to pass an equal arc of wide clearance. To overcome this disadvantage the meter is driven at a constant rate of rotation by the driving system used with the displacement test and the pressure difference is maintained constant by venting a small variable flow of air or gas from the discharge chamber of the meter. This vented gas or air is metered with the diaphragm meter, and its volume reduced to the conditions (i.e., temperature and pressure) that exist within the rotary meter. The simple subtraction of this metered volume from that calculated by multiplying the meter displacement by the number of revolutions gives the clearance flow during the test period.

Since the rate of flow through the clearance spaces will vary with the specific gravity (i.e. density), and viscosity of the gas, it is desirable from this standpoint to make this test with the same kind of gas that the meter is to measure. To do this, the removed section of the inlet pipe is replaced, the inlet valve opened, the meter completely purged of air and the testing equipment used with the displacement test replaced with that shown schematically in Fig. 2. It is noted that both the breather and differential pressure indicator are removed and replaced by the inclined draft gage, and the small rotary reference meter is replaced by the diaphragm meter. During a test the observed quantities are: draft gage reading, number of meter revolutions, time intervals, and volume of gas vented through the diaphragm meter. Determinations of the volume of clearance flow are made at a num-

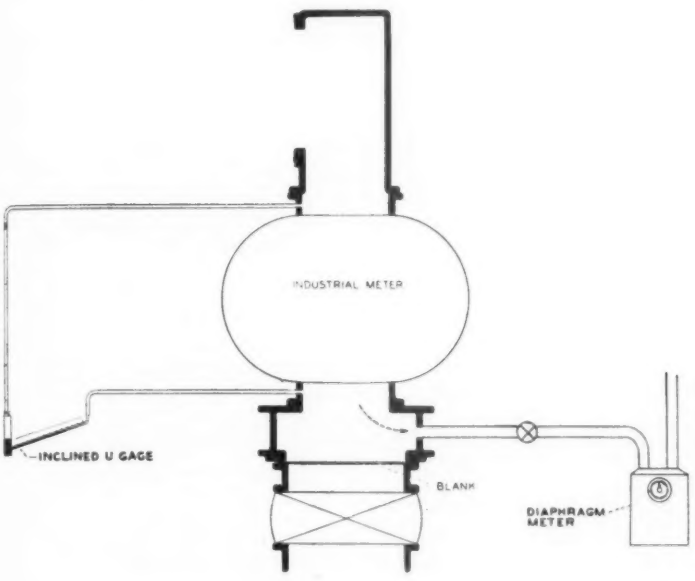


Fig. 2. (left) Diagram of the equipment and connections for the clearance test of a rotary gas meter.

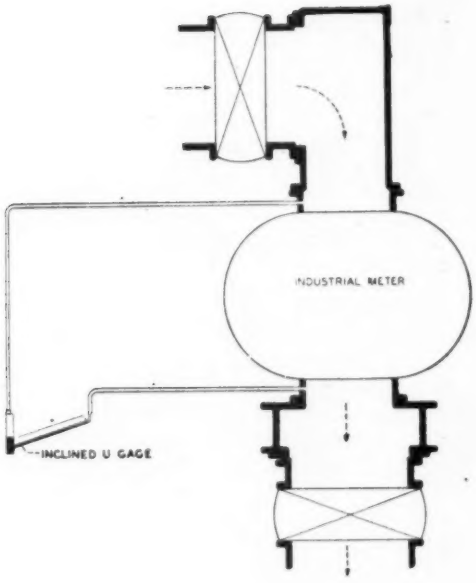


Fig. 3. (Right) Equipment and connections for the rate test of a rotary gas meter.

ber of different pressures covering the operating range of the meter and the results from each is expressed in terms of cubic feet per minute by using the following equation:

$$q_c = \frac{(Nd - V_1)\,60}{t} \qquad (2)$$

in which

q_c (ft³) = clearance flow per minute
N = number of revolutions
d (ft³) = displacement per revolution
V_1 (ft³) = volume of vented gas (difference of diaphragm meter readings.)
t (sec) = test period

Table II shows the observed data and computed results from the clearance-pressure drop test of the 10" × 30" meter.

Auxiliary Clearance Test. In most installations the industrial meter is in a location where small amounts of gas discharged through the diaphragm meter cannot be vented conveniently, so the clearance test is made with air. In this case the test is performed in the manner just de-

TABLE II CLEARANCE TEST

Meter No. 11246
Meter size - 10" x 30"
Rated hourly capacity - 110,000 ft³/hr.
Meter Displacement Listed by Manufacturer - 4.115 ft³
Date - 11-22-40
Location - Southport and Courtland

Differential Pressure	Time Interval	Volume displaced by rotation of Meter	Volume through diaphragm meter	Volume through clearances col 3 - col 4	Rate of flow through clearances 60 x col 5 ÷ col 2
1	2	3	4	5	6
in.H_2O	sec	ft³	ft³	ft³	ft³/min
0.05	92.2	4.115	2.35	1.765	1.15
.10	63.4	4.115	2.14	1.975	1.87
.10	64.0	4.115	1.93	2.185	2.05
.10	64.0	4.115	1.95	2.165	2.03
.20	54.1	4.115	0.87	3.245	3.60
.40	55.2	8.230	2.73	5.48	5.96
.40	54.9	8.230	2.57	5.66	6.19
.40	54.9	8.230	2.54	5.69	6.22
.60	53.4	12.345	5.07	7.28	8.18
.60	53.4	12.345	5.05	7.28	8.18
.80	53.4	12.345	3.44	8.90	10.00
.80	53.2	12.345	3.39	8.96	10.11
1.00	61.4	16.46	3.73	12.73	12.44
1.00	61.1	16.46	3.73	12.73	12.50

scribed; the only difference is that in setting up the equipment the inlet section of pipe is not replaced and the small blower is connected to draw air through the diaphragm meter. Afterwards an auxiliary test is made to obtain factors for computing the rates at which gas would flow through the clearances. To do this all flow through the diaphragm meter is stopped and the differential pressure across the impellers is held constant by varying the speed of the industrial meter. This speed variation as well as the driving force necessary to operate the meter is obtained by the manual operation of the hand wheel and the only test equipment required is a draft gage and a stop watch. One series of tests is made with air in the meter and another series of tests is made after the meter has been reconnected and purged with gas just previous to the removal of the blank in the meter outlet for its return to service. The tests in this series are made at the same differential pressures as were recorded during the regular clearance test with air so individual conversion factors are thus obtained for each originally recorded differential pressure.

While this procedure may not be quite so accurate as that of making the clearance test with gas, no significant differences have been noticed. On the other hand, it has the advantage that it furnishes clearance data on meters which are independent of the gas being metered at the time, and thus facilitates the comparison of meter tests, and provides a basis for a simple method of checking the condition of the meter in the future.

Rate Test. This test consists of observing the differential pressure across the meter impellers corresponding to various operating rates of the meter. The differential pressure is read from the draft gage while the rate of operation of the meter may be determined with a stop watch and the direct observation of a revolution counter or tachometer.

As this test is affected by the gas composition it is always performed in the field under normal operating conditions. To place the meter under these conditions, the hand wheel is disengaged, the inlet section of pipe replaced (if it was not replaced earlier), the blank or water seal in the meter outlet is removed and all the special test equipment except the draft gage is removed. Fig. 3 shows the meter connections for this operation and Columns 1 and 2 of Table III show the observed data taken during the test on the 10″ × 30″ meter.

It should be noted from Fig. 3 that the meter is connected in the line so all the gas passed through the meter goes to the user whose consumption the meter has been installed to measure. As it is desirable to vary the meter speed to cover an extended operating range it will be necessary either to have a bypass around the meter or to arrange with the user to vary the rate of consumption to suit the various rates desired in the test. In some cases the total consumption of the user may be considerably below the rated capacity of the meter but this is not objectionable so long as the actual operating range is covered during the test.

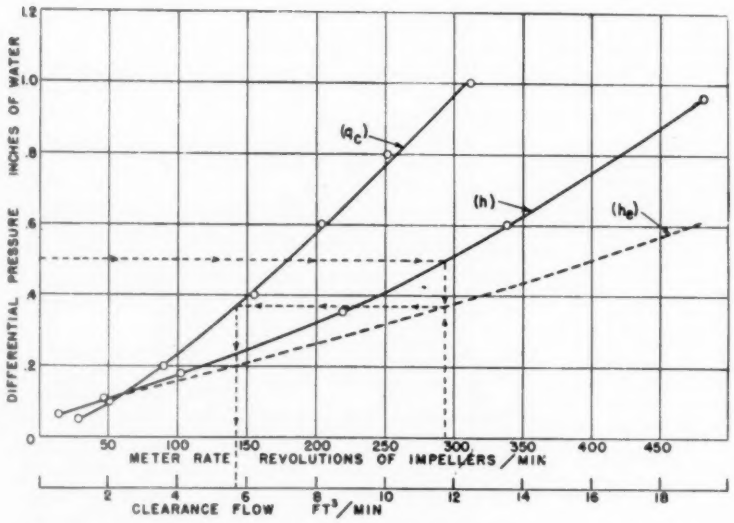


Fig. 5. Curves for the relationship between meter speed, clearance flow, actual pressure drop and effective pressure drop of a rotary gas meter.

q_c (ft.³/min) = rate of flow through the clearances
h (in.H_2O) = actual pressure drop through the meter
h_e (in.H_2O) = pressure drop which is effective in producing the flow through the clearances

Computation of the Meter Proof

The proof of a rotary industrial meter is obtained from the results of the tests described above by a combination of graphical and mathematical steps. The first step is to plot the results of clearance test and

TABLE III RATE TEST & METER PROOF

Meter No. 11246 Meter speed at rated capacity 445.5 rpm Date 3-24-39

Meter Size - 10" x 30" Location - 3921 S. Wabash Ave.

Meter Speed	Observed Differential pres. h	Adjustment for tip velocity 4/3 h_v	Effective Differential pres. h_e	Gas Flow Through Clearance Channels q_a	q_a	Meter Displacement at zero pressure difference	at obs'd pressure difference	Listed by Mfg'r.	Meter proof	Meter Speed % rated capacity
1	2	3	4	5	6	7	8	9	10	11
r.p.m.	in.H_2O	in. H_2O	in.H_2O	ft³/min	ft³/rev	ft³/rev	ft³/rev	ft³/rev	%	%
14.41	.061	.000	.061	1.4	.0972	4.0806	4.1778	4.1150	98.50	3.23
48.16	.102	.003	.099	2.0	.0415	"	4.1221	"	99.83	10.81
102.31	.177	.016	.161	3.1	.0300	"	4.1106	"	100.11	22.96
219.11	.356	.072	.284	4.7	.0214	"	4.1020	"	100.32	49.18
333.94	.603	.168	.435	6.6	.0197	"	4.1003	"	100.36	74.95
481.87	.963	.349	.614	8.3	.0172	"	4.0978	"	100.43	108.16

the rate test on a common mat, as illustrated by lines (h) and (q_c) of Fig. 5. The next step is to compute and plot the values of the effective pressure drop, (h_e), across the clearance channels for the determination of the net clearance flow. The reason for this step, and a fuller explanation of it, are briefly as follows:

When the impellers of a rotary meter are in motion, a velocity pressure is produced just ahead of each impeller tip where it is closest to the meter case. Also, a negative velocity is produced immediately behind each tip. Each of these pressures is equivalent to the velocity pressure corresponding to the tip speed of the impellers. The combined effect of these two velocity pressures tends to produce a flow of gas or air through the clearance space in a direction counter to the flow produced by the normal differential pressure across the meter. Similar velocity pressures acting to produce more flow in the same direction as the main gas flow through the meter, are produced at the so-called contact line between the two impellers. However, the differences between the velocities of the impeller surfaces at this line is lower than that between the impeller tips and case. Similar velocity pressures are produced between the ends of the impellers and meter case but again the average velocity difference between the two surfaces is less and in addition the length of these clearance channels is much greater.

An analysis of the probable effects of these velocity pressures together with studies of the results of numerous meter tests indicated that their combined effects are very nearly equal to 4/3 the velocity of the impeller tips. The effective pressure drop (h_e) is evaluated by the empirical equation

$$h_e \text{ (in. } H_2O) = h - 4/3\, h_c \qquad (3)$$

in which

h (in. H_2O) = total observed pressure drop across meter corresponding to any particular meter speed.

h_c (in. H_2O) = velocity pressure corresponding to the tangential velocity of the impeller tips.

The value of h_c is computed as follows: Let

D (in.) = maximum diameter of the meter impellers

N (rpm) = meter speed

g (ft/sec/sec) = acceleration due to gravity

G (ratio) = specific gravity of the gas, air = 1

v (ft/sec) = velocity

and using

0.075 (lb/ft³) = average density of air at meter

62.34 (lb/ft³) = average density of water in manometer

32.17 (ft/sec²) = acceleration of gravity

then

$$h_c = \frac{v^2}{2g} = \frac{N\pi D^2}{12 \times 60} \cdot \frac{0.075 \times 12 \times G}{2 \times 32.17 \times 62.34} = 4.27\, G\, (ND)^2 \times 10^{-9} \qquad (4)$$

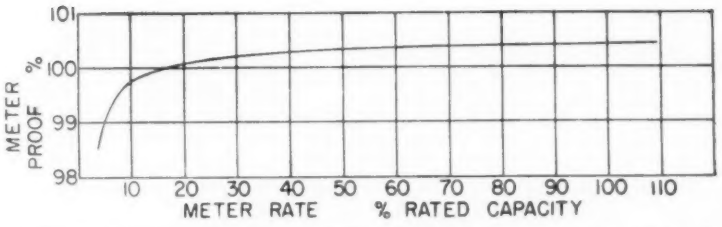


Fig. 6. The proof curve of 10" x 30" rotary gas meter derived by the field test method.

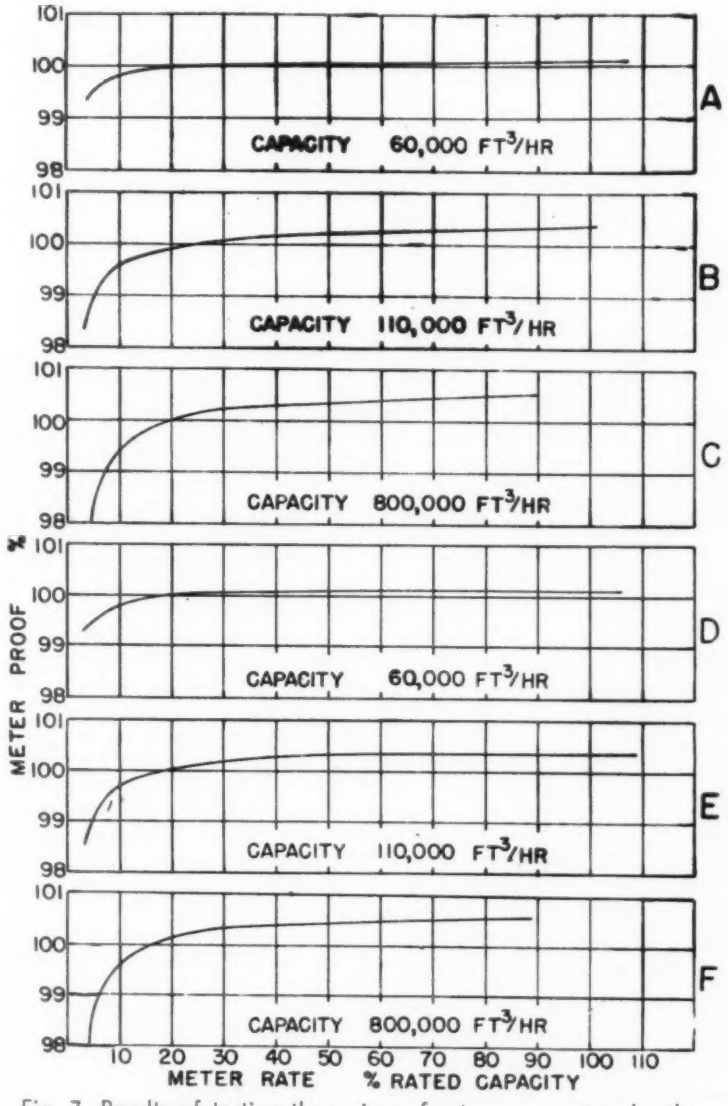


Fig. 7. Results of testing three sizes of rotary gas meters by the field method. Graphs A, B and C show the condition of the meters as found at the time of the test. Graphs D, E and F were obtained after cleaning and oiling the impellers.

Columns 3 and 4 of Table III show values of 4/3 (h_e) and (h_e) computed for the 10″ x 30″ meter, and the values of (h_e) plotted against rpm are shown by the dotted line in Fig. 5.

The third step in the computations is to obtain values of the net clearance flow by means of the three curves of Fig. 5, corresponding to each observed value of the pressure drop (h), column 2 of Table III.

This is done by starting on line (h) with one of the values from column 2, moving vertically down to the line (h_e), then horizontally to the left to the intersection with the line (q_c) and vertically down to the clearance flow scale to read the net value of (q_c). This is recorded in column 5 of Table III.

The fourth step is to divide the values of (q_c) in column 5 by the corresponding values of N, column 1, thus giving values of the clearance flow per revolution. These values are then added to the static meter displacement obtained from the displacement test, thus giving the dynamic displacement per revolution, column 8.

The results of gas meter tests are commonly reported by what is known as the meter's proof. It is the factor, expressed as a percent, by which the indications of a meter must be divided in order to obtain the true volume of gas metered. Hence, the fifth step is to compute the values of the meter proof by dividing 100 times the listed meter displacement, as given by the manufacturer, by the several values in column 8 and listing the results in column 10.

These computations are all that are needed as far as any individual meter is concerned. However, in order to be able to compare the proof curves of meters of different design and size, it is desirable to refer them to a common basis. Such a basis is obtained by expressing the meter speed as a percent of the meter speed at rated capacity. The speed at rated capacity is obtained by dividing the rated capacity of the meter, as given by the manufacturer (usually given in ft^3/hr), by 60 times the listed displacement. Hence, the sixth and last step in the computation is to divide 100 times the meter speeds of column 1 by the rated capacity speed and listing the results in column 11. The result of plotting the values in column 10 against those of column 11 is shown by the curve of Fig. 6.

Some Results from Tests of Rotary Gas Meters

Fig. 7 shows the results of testing three different sizes of rotary gas meters by the field method. The top three graphs are the results of tests made immediately after the meters were disconnected from service. The bottom three graphs are the results after the impellers had been cleaned and oiled. By comparing the first with the fourth, and so on, it appears that the cleaning and oiling had almost no effect on the values of the meter proofs.

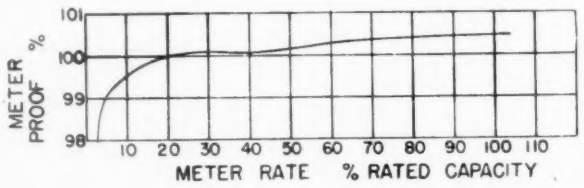


Fig. 8. Proof curve of a new rotary gas meter of 110,000 chf capacity. Note the very small difference between this curve and those of Fig. 7, B and E.

Fig. 8 shows the proof curve for a new meter of the same size as that of graphs B and E of Fig. 7, which had been in service over five years. This illustrates the very small difference which was found between the calibration curves of new and used meters of the same size. As there were a number of other cases similar to this, it appears probable that the effect of age upon the proof curve of these meters is almost negligible, at least within the age limit (about 20 years) of the meters tested up to the time of making this study. Indeed, so long as the impeller bearings are maintained in good condition so that the impellers rotate freely with no marked increase in the pressure drop across the meter, neither length of service nor the accumulation of scale and tar deposits from unpurified gas seemed to have any marked effect upon the proof of the meters.

The following is a summary of the results from testing more than 17 rotary gas meters, ranging in capacities from 12,000 to 800,000 ft per hour.

1. The average proof of the meters, in good mechanical condition, over the range of 5% to 150% of rated capacity, is between 98% and 101%.

2. The proof curve of any individual meter is within ±0.25% of the group average over the range of 20% to 150% of rated capacity and is within ±0.5% of the group average over the range of 10% to 20% of rated capacity.

3. The size of a meter has very little influence on its proof curve when the meter speed is expressed as a percent of the meter speed at the manufacturer's rated capacity or speed for the meter.

4. The static displacement of a rotary gas meter appears to be almost unaffected by corrosion or deposits, even those resulting from unpurified gas. Hence, having been once determined, it will seldom be necessary to be redetermined.

5. After a rotary meter has been tested once by the field method including a hand operated clearance test for reference, its condition at any subsequent time may be ascertained by making a simple hand operated clearance test. If the result of this test does not differ by more than 50% from the original, the percentage change can be applied directly to the clearance curve and a new calibration curve developed.

6. The internal surfaces of a rotary meter can be cleaned satisfactorily, with a minimum interruption to the customer's service by several flushings of the meter with a noncorrosive solvent.

In general, the mechanical condition of a rotary meter can be estimated while in operation by comparing the pressure drop across it with that observed in the original test for the same meter speed. So long as there is no radical change in the speed-pressure drop relation, its condition may be assumed to be satisfactory.

Process Controllers: Instruments and controls for Process Industries is the title of Bulletin, No. 17, issued by Bailey Meter Company, Cleveland 10, Ohio.

Process controllers, control components, measuring components and instrument combinations are briefly described and illustrated. Application data such as sizes, pressure standards and ranges are listed for the various components.

Typical control systems of both the single and multiple element type are illustrated.

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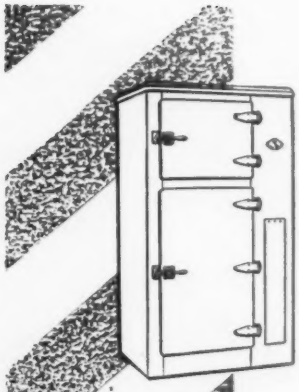


Twenty years ago . . . the first Servel marked

Today
Servel brings you the finest Gas Refrigerator ever built

YES, it's just twenty years ago since Gas Companies offered their customers a revolutionary advance in refrigeration . . . the permanently silent, long-lasting Servel Gas Refrigerator. You may remember how excited your customers were in 1926 about the first automatic, water-cooled Servel. For the first time you dramatically demonstrated the Gas Refrigerator that has no moving parts in its freezing system to wear or get noisy.

With each succeeding year, you brought your customers a finer, constantly improved Servel. In 1933, you introduced the first air-cooled Servel—the Gas Refrigerator that has proved so popular with millions. Then came such sales-stimulating improvements as non-tipping shelves, dry or moist meat storage, one-piece steel cabinet, trigger release of ice trays, double-action door handle, temperature dial, cold indicator and many others.

Now the finest Servel ever built will soon be rolling off the line. The crowning achievement of twenty years of progress and research in Gas Refrigeration, the great new 1947 Servel will bring your customers the finest in modern food storage. There's lots of space for frozen foods in Servel's big Frozen Food Locker. The 8-cu.-ft. model holds a bushel basketful—up to sixty standard packages of frozen foods. Your customers also get an abundance of ice cubes and constant cold year in, year out. All of Servel's other big features are included in a new, streamlined Gas Refrigerator that will live up to the highest standards of performance and dependability. And, naturally, Servel continues to lead the field with its basically different freezing system. The Servel Gas Refrigerator is still permanently silent, built to last for years, economical to operate.

See the great new 1947 Servel on the stage at the A.G.A. Convention in Atlantic City. You'll agree it *is* the finest Servel ever built . . . and that it dramatizes, as never before, the modernity of Gas and Gas Service.

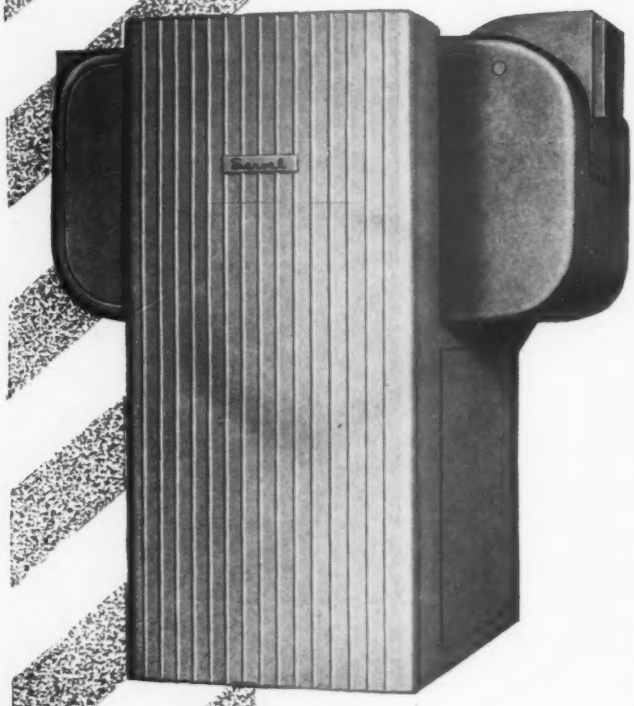
and twenty years of progress and research

a milestone in the history of the Gas Industry
POTATOES
ICE CREAM
SPINACH
ASPARAGUS
GREEN PEAS
PINEAPPLE
have added new members to the Servel family

Next Servel introduced the...

All-Year Gas Air Conditioner

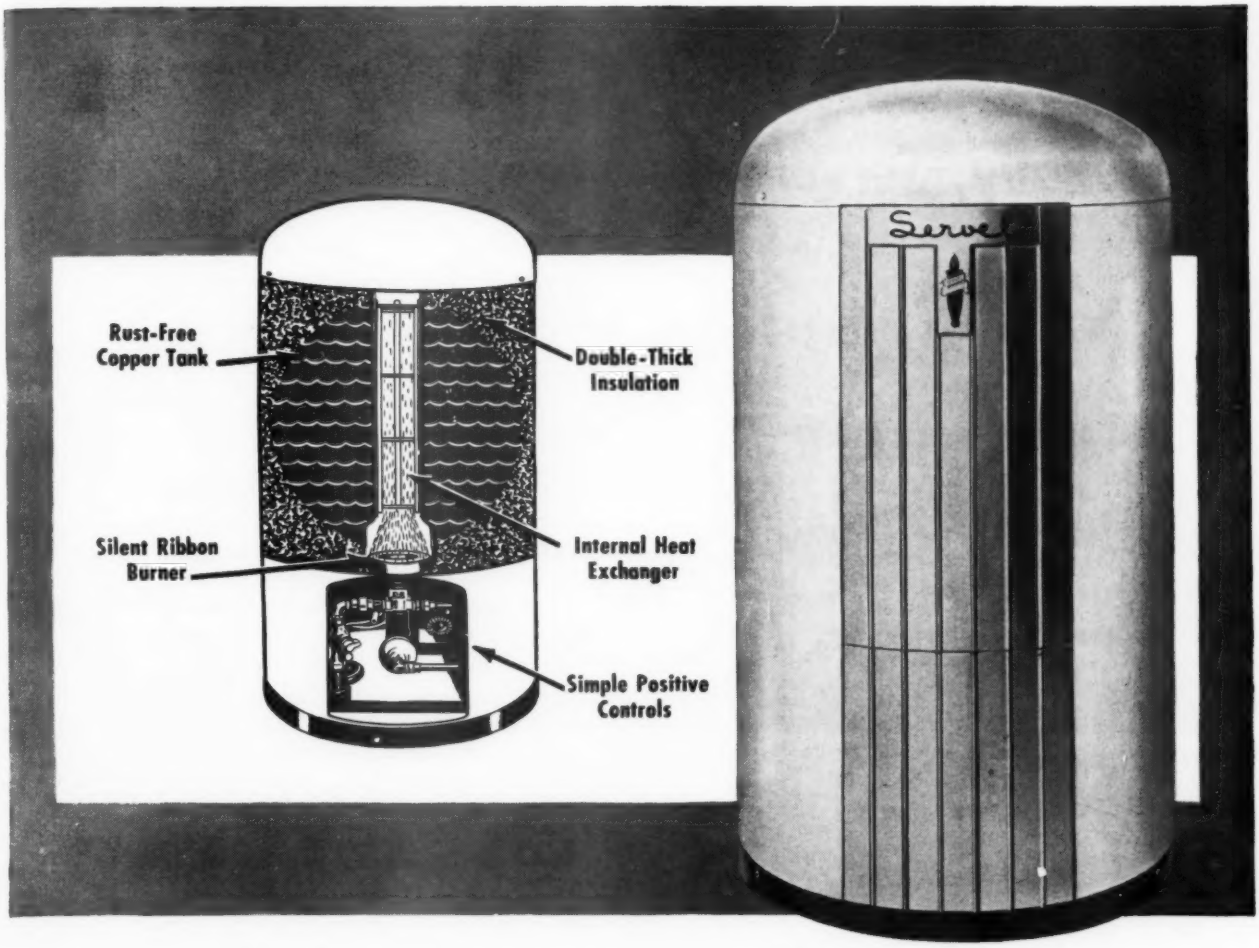
to help you dramatize "Gas—the modern fuel"



IN 1940 Servel announced the greatest advancement in scientific air conditioning for the modern home—the Servel *All-Year* Gas Air Conditioner. Years of laboratory research plus hundreds of field tests proved that this engineering achievement provides a new concept in living comfort . . . a concept which marks it as the most modern, up-to-date equipment of its kind.

For the Servel *All-Year* Gas Air Conditioner actually creates a "new quality of living" for today's homes and commercial shops. It cools and dehumidifies in summer, heats and humidifies in winter, filters the air and circulates it at room temperature between seasons. All these vital functions are provided by *one unit* . . . all are regulated by one central control, the "Selectrol."

In more than 400 installations—some operating for more than five years—the Servel unit has received wide acclaim for its efficiency, economy, and dependability. Leading financing agents have stated that it keeps homes modern longer. Surveys show that 72 per cent of the people who plan to buy or build homes have said they wanted all-year air conditioning. These are good *extra* reasons why it pays to promote the Servel *All-Year* Gas Air Conditioner to the hilt today and in the years to come.



Now Servel announces a different, finer

Gas Water Heater

Now families in your community can enjoy the year-round comfort and convenience of an abundant hot water supply with the new, basically different Servel automatic *Ball-Type* Gas Water Heater. Built from an advanced scientific design, it offers exclusive advantages that will help you demonstrate the modernity of gas as a household fuel.

Unlike ordinary water heaters, the water tank of the Servel is shaped like a ball instead of a cylinder. And a ball is the strongest shape known to science. Here's what this means to your customers:

The extra strength of the Servel automatic *Ball-Type* Gas Water Heater assures added life and durability. This quality gas appliance will also be more economical to operate. For the Servel *Ball-Type* tank *radiates and wastes an average of 18 per cent less heat* through its walls than a conventional cylinder-shaped tank of the same capacity.

These unmatched advantages, together with the others shown above, make the new Servel automatic *Ball-Type* Gas Water Heater the top value in the field. You'll find it's easy to sell . . . requires minimum maintenance throughout its long life.

Three De Luxe models—20, 30, and 45 gallons to meet every need—are now available. These newest additions to the famous Servel family will quickly boost your appliance volume—protect your gas load, too.

plus another great promotion

Finally, Servel presents . . .

SERVEL-DESIGNED

New Freedom Gas Kitchens

Special Air Control Cabinet Provides Comfort-conditioning

REALIZING that the future of the domestic gas load depends largely upon a growing acceptance of gas as *the* fuel in the kitchen, Servel in 1945 developed and announced the first complete New Freedom Gas Kitchens.

An outstanding feature of the Servel-designed New Freedom Kitchens is a special Air Control Cabinet built over the gas range. This cabinet comfort-conditions the kitchen . . . provides for the movement of air and removes objectionable cooking odors and moisture. At the same time, it filters out grease and grime resulting from cooking.

Gas Companies have found that these modern kitchens open new scope for selling Kitchens for Family Living. They are backed by a scientific styling and merchandising program that not only promotes kitchen cabinets, but also gas appliances and gas as a fuel.

For 1947, Servel plans to expand into the kitchen field. Model kitchens for display are going forward as fast as possible. Each is uniquely different, interest-provoking, yet completely practical.

★ ★ ★

BE SURE TO SEE THE GREAT SERVEL EXHIBIT ON THE STAGE AT THE A.G.A. CONVENTION, OCT. 7 TO 11, IN ATLANTIC CITY

Servel, Inc.

Natural Gas Reserves of California

THE TOTAL natural gas reserve in California, as of January 1, 1946, was 11,421,450,939 Mcf, according to a report based on a special study of all gas producing areas of the state made by engineers of the California Railroad Commission and the Division of Oil and Gas, Department of Natural Reserves.

The study was completed June 1 and made public in printed form as Special Study No. S-525, in August. Engineers responsible for making the reserve estimates contained in the report were F. C. Hodge, petroleum engineer of the State Division of Oil and Gas; and John F. Dodge, professor of petroleum engineering, University of Southern California, Los Angeles.

A statistical resume showed that estimated reserves of casinghead gas, as of January 1, 1946, were 6,838,347,030 Mcf; of dry gas, 4,532,717,814 Mcf; and underground storage gas, 50,386,095 Mcf.

By producing areas, the adjoining estimates of reserves, as of January 1, 1946, were contained in the report:

Estimated Reserves as of Jan. 1, 1946

	(Volumes in Mcf)
Casinghead Gas:	
San Joaquin Valley fields (21)	4,981,336,164
Coastal Fields (8)	811,994,819
Los Angeles Basin Fields (19)	1,045,016,047
Total casinghead gas	6,838,347,030
Dry Gas:	
Northern and Central California	3,772,152,146
San Joaquin Valley Fields	760,565,668
Total dry gas	4,532,717,814
Underground Storage:	
San Joaquin Valley Fields	3,976,865
Coastal Fields	43,133,115
Los Angeles Basin Fields	3,276,115
Total	50,386,095
Total dry and underground gas storage	4,583,103,909
Total gas reserves in California	11,421,450,939

Included for each of the major casinghead or dry gas producing fields of the state is a discussion of the field, a description of the basic method used in estimating the reserve, and an estimate of the total future recoverable gas, as of January 1.

In the preface it is pointed out that since the operating properties which produce the gas with which the report is concerned are almost without exception owned by oil companies rather than public utility gas firms, it was to the oil companies that those responsible for the preparation of the report turned for the factual data. This was augmented by other information on file with the Division of Oil and Gas.

A review of the 66 separate gas reserve area estimates included in the report showed that 82 per cent, in terms of volume, represent initial estimates or re-estimates. During the period covered by the report no new major reserves were discovered in the state.

Estimates Show Increase

The report disclosed further than the original estimate reserves, adjusted to July 1, 1945, totaled 10,971,380,063 Mcf whereas the estimated reserve as of January 1, 1946, was 11,679,133,518 Mcf. The inclusion of 707,753,455 Mcf in the more recent estimates reflects, the report explained, (a) the inclusion of reserves for certain fields not previously included; and (b) the re-estimation of reserves or certain fields where data obtainable since the time of the original study so indicated.

It was announced that it is planned to prepare supplemental gas reserve estimates at 6 month intervals hereafter in order to maintain current the estimated reserves of the state.

A separate chapter in the report is devoted to each of the state's 48 gas producing fields. These include historical data, location, geological information, contour maps and gas reserve tables and graphs for each field.

Historical Outline

A brief history of gas utilization in California is also included. The development of the gas industry is related from the earliest use of natural gas at Stockton in 1863, where gas was produced from an artesian well, to the first production of gas from oil produced in 1870, the initial distribution of oil field gas by the Santa Maria Gas Co. in 1907, to the construction of the first natural gas line to Los Angeles in 1913, and the subsequent developments.

Since January, 1927, the report stated, the Los Angeles metropolitan area has been entirely served with 100 per cent natural gas. In 1940, according to the report, about 10 per cent of gas utilized by gas companies in California was dry gas. Since 1937 the amount of dry gas produced has increased annually, principally because of the large reserve and availability of dry gas in the Rio Vista field.

Dry gas accounted for the following approximate percentage of total gas company disposition of own gas in the years indicated:

1943 .....40%
1944 .....43%
1945 .....42%

The report set forth that the major portion of California's supply of gas, as at present distributed, is casinghead gas, the rate of production of which is tied to the rate of oil production by natural laws. The report emphasized that the supply, therefore, is relatively flexible.

Gas Storage

The compilers of the study stated that a highly desirable means of adapting supply to demand lies in the utilization of wholly or partially depleted underground oil or dry gas fields as storage reserves into which temporary or seasonal surplus gas may be injected.

Cited was the Playa del Rey field in Los Angeles County.

"Beginning in 1943 until June, 1945," the report stated, "a total of 3,845,131 Mcf of gas had been injected in the depleted area of the Playa del Rey field. (See AMERICAN GAS JOURNAL, December, 1944, issue, Page 28). State Railroad Commission engineers estimated on June 1, 1945, that only 1,217,449 Mcf of the total of accumulated gas injected remained in the reserve sands."

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ONCE AGAIN American Meter Company will do its part by participating fully in the largest Atlantic City exhibit ever held in conjunction with an A. G. A. Convention.

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Some forty-four items representative of a complete line of Tinned Steelcase and Ironcase Meters, Orifice Meters,

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MEASUREMENT ENGINEERS

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Reliance Regulators and Laboratory Apparatus will be presented for the inspection of the industry. You are cordially invited to attend the exhibit, October 7 to 11, 1946. More and more as material shortages are alleviated "Its the Inside That Counts" in successful measurement with American Meter Company instruments.

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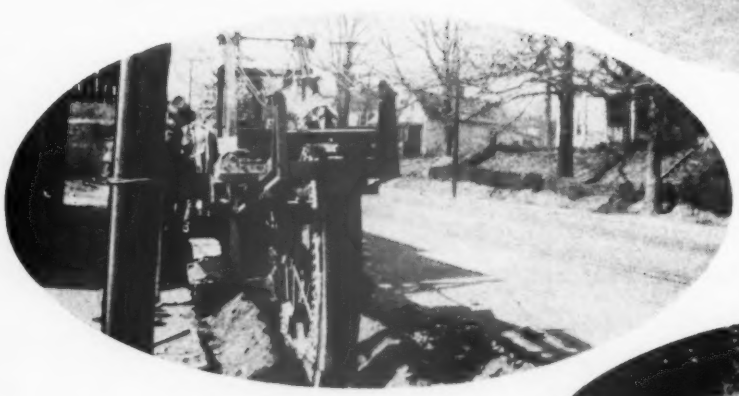

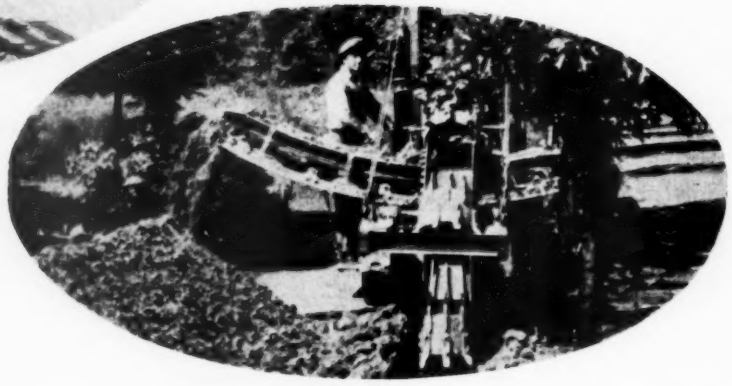

You are cordially invited to visit us at the A. G. A. Convention (Booths 603-604) and see the newest BABY DIGGER on display.

Thousands of miles of completed trench, dug on hundreds of Gas projects during the past 25 years prove the correctness of the BABY DIGGER'S original distinctive full crawler mounted digging wheel design.

This sound basic design plus Cleveland's continued alertness to customers' requirements, a definite fixed policy of aggressive open-minded engineering and an unchanging devotion to the finest quality of construction detail assures you that today's Baby Digger is more than ever THE TRENCHER for your distribution and service jobs. It is:—

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20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Economical Mechanization for A Widespread Gas Area

By

Jas. E. C. Currens

Pacific Gas & Electric Co.

GENERAL CONSTRUCTION is a head office outfit operated from San Francisco. Its purpose is to relieve the Divisions of Interdivision Cross Country Jobs and certain peaks of what could be called Division Jobs. Division Jobs are ordinarily handled by either one of two kinds of crews.

Heavy crews made up of above six men total and usually about 8 to 12 men, or they may be handled by "Light Crews" of not more than six men. General Construction Crews in our Area average 16 men with top of 25.

"Mechanization of a Crew" refers to the organization of the work, personnel and equipment so that the work proceeds with a minimum of special intention, but, it is necessary to supply a maximum of planning on the part of supervision, to the end that the work will be done better, more uniformly, with a higher grade of skill on part of worker, with more key men and a minimum of men assigned to drudgery and with the highest possible load factor on all equipment.

Because of the diversity, the size, location and traditions of no layoffs, the Division Construction jobs lend themselves reluctantly to "mechanization."

The pressure for mechanization comes from two sources. The Division Manager who is concerned by the fact that many of his prospective customers at present speed of construction cannot be cared for for months. Second from the Operating Superintendent who is concerned faces. Both are pointed toward by the mountain of work which he mechanization by the fact that Divisions cannot easily lay people off. The man to be laid off is a neighbor, a friend, a homemaker or a substantial member of the Community. Divisions cannot live with people and be constantly hiring and firing. So, before a mass of labor is hired, other means must be exhausted.

In the face of the above we propose production methods of getting pipe into the ground and, because we are home people, before a mass of labor is hired the following steps should be taken:

1. Exhaust all the relief which may be obtained from crew and work organization with present forces.
2. Exhaust all the relief which may be obtained from increased use of present mechanization as evidenced by high load factors on individual units. Check hour meters on machines.
3. Increase use of other than Division crews to handle peak loads.
4. Increase mechanization.
5. Increase personnel.
6. Check personnel while on casual basis to insure retaining the best qualified people.

This is an abstract of a paper on the subject of "Economical Mechanization for A Wide-spread Gas Area", presented by J.E.C. Currens at a meeting of the Technical Section, during the Annual Meeting of P.C.G.A. at San Francisco, September 10th-12th.

With suburban building developments increasing rapidly all over the country, a vast extension of gas pipe lines will be necessary to service these new homes with gas.

Mr. Currens presents valuable data on the equipment necessary, man power requirements and costs. Every gas company planning the extension of gas lines will get helpful information from the data prepared by Mr. Currens. —ED.

Ideal Production Methods

"THE SPREAD."

In a truly mechanized operation the spread is the backbone of the work. "The spread" is a collection of sub-operations in fixed sequence that progress over the work. The spread can be stationary physically and the work move across it, or the spread can move over the work as in the case of a long modern pipe line job. The introduction of a spread on a job immediately mechanizes it to a large extent no matter how crudely the spread is implemented as far as tools and equipment are concerned. Immediately because of a fixed order and because of repetition of same operation an employee on the crew moves "without special intention and reflection." In other words confusion and indecision are removed, everyone knows just what to do and does it.

Mechanization on the Cross Country Pipe Line Job

The best field example we have of mechanization is the long cross country job.

In this type of a job the mechanization is perfect.

(1) Before work starts the job is completely engineered. Drawings are available and every bolt and screw listed on all special features.

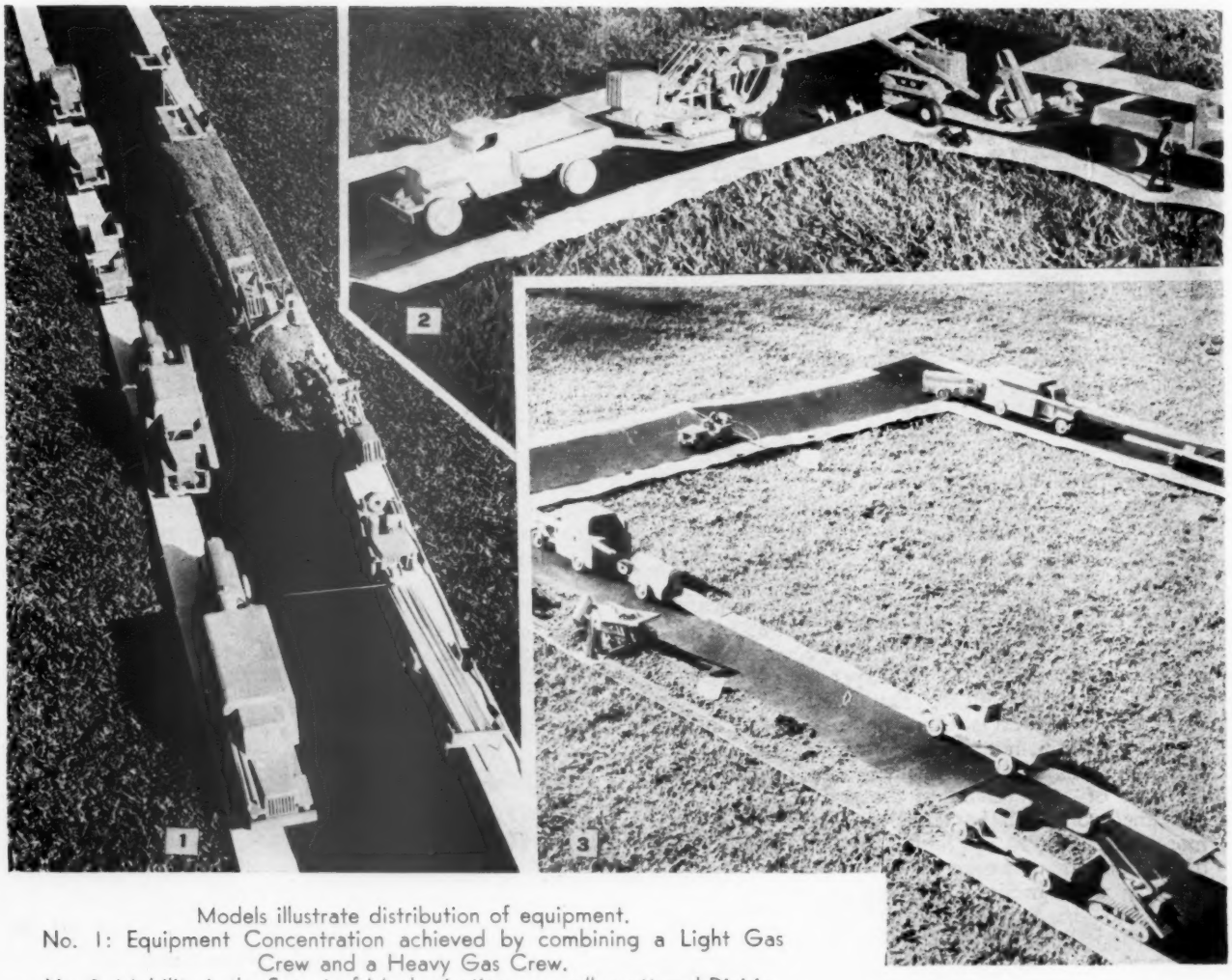
(2) The job is put into standards which are clear, defined and all workmen are advised.

(3) The job is implemented with just enough machines and transportation to do the work.

(4) Specialists are on each operation in the spread.

(5) Each element in the spread is timed to travel at a given rate, say a mile a day.

(6) The spread is fed on to the job with first units first and it then proceeds automatically to the end where successive units then fall off the line, the head units first and so to the last unit.



Models illustrate distribution of equipment.
No. 1: Equipment Concentration achieved by combining a Light Gas Crew and a Heavy Gas Crew.
No. 2: Mobility is the Secret of Mechanization on small, scattered Division Jobs. This view shows trencher loaded ready to travel, 5 miles to a headquarters Job, 50 feet or more in length; or 50 miles to a 300 foot Job in another Division. The backfiller is accompanied by trench roller and loader bucket.
No. 3: The Cross Country Spread applied to three grouped Divisional Jobs. Beginning at the Upper Right we have: pipe stringing, Welding into "strings". Testing strings, Trenching, backfilling and compacting. The shadow of the trencher, advancing, is seen upper left. The "clean up" of the street is seen lower right.

"A Study in Quantity Production of Main"

1. We plan to study the requirements, difficulties and advantages experienced in several widely varying types of gas main installations:
   a. Metropolitan—difficult. Class I.
   b. Scattered Suburban—average difficulty. Class II.
   c. Rural—simple, easy. Class III.
2. We will study the lineup of operation in the large mechanically equipped spread on a cross country line. This study should show the maximum benefit which can be experienced from crew organization because of the simplicity of the job and the absence of interferences.
3. We will study the interferences mentioned in the three types of jobs which prevent the application of the ideal spread.
4. We propose to evolve a particular adaptation of big line methods to our small scattered jobs of the types listed above.
5. We propose to evolve a plan to combine our small jobs, use a big line spread, move progressively from job to job, rather than the system of sending a crew to one job with all men on the job until it is completed.

Rural Jobs. Class III Jobs

A simple job, without interference beyond city pavement and largely in the cultivated section of country roads. The spread is as follows:

1. Delivery of pipe. This work is done by an independent unit of two men and a truck who move the pipe direct from the car or warehouse and string it along the route of the line. An improved type of telescoping 2-wheel trailer is used. The accompanying photograph illustrates this equipment. Any of our pipe in 40 ft. lengths handled on the sides of trucks is done in violation of State Highway regulations.
2. Welding. Welding is done by two men, a welder and a helper, who merely make the string welds and do no wrapping or testing.
3. Heavy Crew Work. Seven men of a heavy crew under a foreman next arrives and welds the "strings," test and wrap joints and fittings. Next the mechanical trencher arrives on the 2-wheel trailer with an operator and laborer. The ditch is dug out as far as can be done mechanically; the heavy crew now being on the job, skips are cleaned up and the pipe and ditch are ready for laying operations. After laying, the backfiller arrives, usually a motor patrol rented from the city or county at

—COSTS TABLE I—

SEGREGATED COSTS OF OPERATING CLEVELAND TRENCHER S-5 DATE JULY 1-31,1946

MACHINE DATA	DIVISION	MARIN DIST.	VALLEJO DIST.	SONOMA DIST.
Jobs worked	40	8	13	19
Operating Days	28	11	8	9
Hrs. Trenching	163	66 1/2	43 1/2	53
Hrs. Moving	52	14	21	17
Hrs. Greasing	21 1/2	7	7 1/2	7
Hrs. Repairing	9 1/2	5	4 1/2	0
Trailer Miles	987	149	559	280
Feet Trenched	21498 Incl. Services	8210	6230	7058
Avg. Dim. Ditch	10 x 28 Inches	10 X 27 Inches	10 X 29 Inches	10 X 27 Inches

LABOR	HOURS	COSTS	HOURS	COSTS	HOURS	COSTS	HOURS	COSTS
Operator	163	231.22	66 1/2	103.17	43 1/2	57.74	53	70.31
Moving	52	84.02	14	19.94	21	37.19	17	26.89
Greasing	21 1/2	29.85	7	10.63	7 1/2	9.97	7	9.25
Repairing	9 1/2	15.27	5	9.29	4 1/2	5.98	—	—
Helper	—	—	—	—	—	—	—	—
Moving	—	—	—	—	—	—	—	—
Greasing	—	—	—	—	—	—	—	—
Repairing	—	—	—	—	—	—	—	—

FUEL								
Gasoline	249	49.80	95	19.00	76	15.20	78	15.60
Oil	31	4.65	12	1.80	12	1.80	7	1.05
Grease	44	6.60	16	2.40	16	2.40	12	1.80
Parts Repair	—	—	—	—	—	—	—	—

SUMMARY OF COSTS - BASED ON OPERATION OF MACHINE

	Costs	Cents Per Ft.	Costs $ Per Hr.	Costs	Cents Per Ft.	Cost $ Per Hr.	Costs	Cents Per Ft.	Cost $ Per Hr.	Costs	Cents Per Ft.	Cost $ Per Hr.
Operator	231.22	1.08	1.42	103.17	1.26	1.56	57.74	.93	1.33	70.31	.99	1.33
Helper	—	—	—	—	—	—	—	—	—	—	—	—
Gasoline	49.80	.23	.31	19.00	.23	.29	15.20	.24	.35	16.20	.23	.31
Oil & Grease	41.10	.20	.25	14.83	.18	.22	14.17	.23	.33	12.10	.17	.23
Repairs	15.27	.07	.09	9.29	.11	.14	5.98	.10	.14	—	—	—
Moving	192.59	.90	1.18	36.33	.44	.55	98.68	1.58	2.27	57.69	.82	1.09
Auth. $ Per Day												
TOTALS	529.98	2.48	3.25	182.62	2.22	2.76	191.77	3.08	4.42	156.30	2.21	2.96

PERCENTAGE OF DITCH TRENCHED AND HAND DUG. MAIN ONLY 10,203 FT. SERVICES

	%	Ft.	%	Ft.	%	Ft.	%	Ft.
Trenched	57	11295	57	8210	75	1620	45	1465
Hand Dug	43	8477	43	6137	25	548	55	1792
Total		19772		14347		2168		3257

$6.48 per hour. This unit has backfilled as much as 2000 ft. per hour. The backfiller needs no assistance and on completion of the work, the job is done so far as men are concerned.

4. Welding Services.

a. Sales Department selects those service orders which, should be laid as approved and grouped.

b. Four to six jobs are given to a service crew who plan to complete two services per day.

c. If the customer is ready, this crew also sets the meter.

The above is the plan of procedure for simple rural jobs only, Class III. Costs by this plan are low and are included in the adjoining table. The table gives, average data, the most expensive job and the least expensive. You will note that the total field labor on the lowest job amounts to 16c per foot. This is for straight timecard labor, no overhead of any type. Overheads are shown in Columns 3 and 4. The average job was done for 33c per foot and the top price 40c. These costs seem exceptionally low and an effort was made to rationalize them. Attached find a table of costs built up from the basic operations and you will note that the total labor, as defined above, built up from basic costs amounted to 25c per foot. A great deal of the savings over estimated costs was made in trenching and in backfilling and tamping. Trenching has been done for 5c per foot or $5.50 per hour for the machine. It is not difficult to dig 100 feet per hour. Backfilling, as you can see above, can be done for half a cent a foot where tamping and compacting restrictions are not severe. A Cleveland 110 costs $10.00 per hour, rental.

Together with this Spread are several other practices which should be included in the description of the operation.

1. Foremen are notified of their jobs well in advance. In fact, they are given 5 or 6 jobs at a time. This allows the crew foreman to plan with his General Foreman and do the preparatory work which is necessary if a trencher is to be used operating with a high load factor. It is impossible to expect results in the case in which a foreman is handed a crew and his job authorization. There is bound to be a long lag and waste of valuable skills while engineering features are discussed, material is collected and the early operations of a job are started.

2. Under the system above, pipe may be delivered by two men a week ahead of the arrival of the trencher. This early delivery of pipe allows welders to get the bulk of the welding completed so that when the trencher arrives it will only be necessary to weld up gaps at road crossings and driveways.

3. All of the paper work including orders, permits, rights of way, subdivision surveys, sketches, locations of the end of the main, service orders, District regulator sets, and any other forms that are necessary for the job are handed to the foreman well in advance of his start.

4. Copies of material orders are sent to the warehouse who at once begin to accumulate in special bins, material needed for all the jobs in the series to be undertaken.

5. Sufficient transportation is furnished so that small units may be broken off from the main crew to handle particular operations such as hydrauger crossings at cross streets, welding and setting up District regulator pits, pouring meter foundations and setting meter and regulator sets, special stream crossings, and any other special fixtures which would hold up the Spread; as it advances, these jobs are worked out ahead of the main crew.

6. Skillful use of the backfiller is required so that as quickly as a reasonable length of main is ready and in place, the backfilling operation starts each day. A start is usually made about 3 o'clock in the afternoon so that by 6 all of the trench open during the day has been closed to within 60 ft. of the trencher. This eliminates heavy use of barricades, sidewalk bridges, driveway bridges and lanterns.

Summing up the secret of the success in applying big job methods to groups of small jobs lies in the skillful handling of the trencher and backfiller. The pipeline is prepared ahead of time so that each day the trencher and backfiller complete, install and close all ditch.

Services have not been mentioned in this Spread and rightly so because the main is laid and buried without regard for services. After the mechanized portion of the crew has left the job the remaining crew portion cleans up, completes services, and puts the extension in operation.

During the preparatory period before trencher and backfiller arrive and during the cleanup period after trencher and backfiller have left, the crews are the normal permanent size found in the District. In one Division the extra personnel for use with trencher and backfiller and also the extra transportation are concentrated on a job by combining a light and a heavy crew with all of their individual equipment.

Let us list for clarity the facilities which the senior foremen would have at his disposal in this case.

(1) He would have a sub-foreman.

(2) He would have at least a welder and an apprentice welder, in addition to the light crew foreman who also welds.

(3) He would have a minimum of 16 men.

(4) He would have 2 1½ Ton gas trucks, one heavy and one light with Gas Department tools on each.

(5) He would have at least 2 compressors, 2 welding outfits and a pickup.

Costs of Class III Jobs

TABLE II

SUMMARY OF ACTUAL COSTS OF TEN BEST RURAL JOBS.
2" Pipe Cost Per Foot = $0.19, Wrapped

	Column 1 Total Feet Laid	Column 2 Total Field Costs $/Ft.	Column 3 Total Over Head $/Ft.	Column 4 % of Over-Head On Field	Column 5 Total All Costs $/Ft.	Column 6 Labor Cost $/Ft.	Column 7 % Labor of Total
Average	890′	.63	.10	16.2%	.73	.33	45
Lowest	426′	.41	.06	12 %	.47	.66	34
Highest	1916′	.82	.19	23 %	1.01	.40	39

Column 2 Includes pipe cost, Fittings, Rentals, Personal Expense, Material, Stores, Transportation, Tool Expense, Payroll, Payroll Taxes and Retirement Plan Contribution.

Column 3 Division Supervision, General Engineering and Administrative Expense.

TABLE III

COMPOSITION OF VERY IDEAL BASIC LABOR COSTS TO PRODUCE A TOTAL LABOR COST PER FT. THIS INCLUDES NO OVERHEAD, INSURANCE, OR OTHER EXTRAS.

I	Trenching	$.05/ft. or $9.50/hr.	.10
II	Welding & Fitting	$1.00/Lin. ft.	.04
III	Wrapping		.04
IV	Into Ditch		.01
V	Back Fill		.03+
VI	Tamp.		.03—
			$0.25

(6) With the trencher would come a trailer and a 1½ Ton dump truck.

(7) With the backfiller would come another trailer and 1½ Ton dump truck.

Of course, the crews would already be combined before and during the time the extra Mechanization arrived in the District. After the main was laid, crews would split up and run the services.

You can see that with a light and heavy crew for personnel, the backfiller and trencher cannot stay in one District and operate at maximum load factor for much longer than a week. In the interim the inter-Division mobile mechanization is moved to the next Division or next group of jobs.

. . . . . .

Class III Job: How Short A Job Can Be Worked 5 Miles from the Base?

Assume 10 miles Travel R.T. @ Clearance Rate of $.20/Mile	$2.00
Assume Loading & Unloading @ $1.25 Each	$2.50
Assume Labor Going & Coming 1 Hour @ $2.50	$2.50
Total	$7.00

Assume Hand Digging easy @ 50 ft. per man per 8 hours @ $1.05 per hour or $.17/Ft.
Assume trencher costs $.03/Ft. after on the job

We have:

$$\$.17X = \$7.00/\$.03X$$
$$.14X = \$7.00$$
$$X = 50 \text{ Ft.}$$

X = Footage to Break Even

How Short A Job Can Be Worked 50 Miles from the Base?

Assume Drive of 50 Miles 100 Miles R.T. Truck Clearance Rate $.20/ Mile	$20.00
Assume Labor Driving 6 hours @ $2.50	$15.00
Assume Loading and Unloading @ $1.25 Each	$2.50
Total	$37.50

Assume after on job, trencher Cost Company $.03 per foot
Assume hand digging local easy 56 ft. per day per man at $1.05 per hour or $.17 per foot

We have:

$$X\ \$.17 = 37.50 + X\ \$.03$$
$$\$.14X = 37.50$$
$$X = \frac{37.50}{.14} = 270 \text{ Ft.}$$

If X = Footage to break even

Conclusions

1. Mechanization pays on a footage basis on jobs over 50 ft. at the home base or on jobs over 300 ft. 5 miles from the home base.

(Concluded on page 78)

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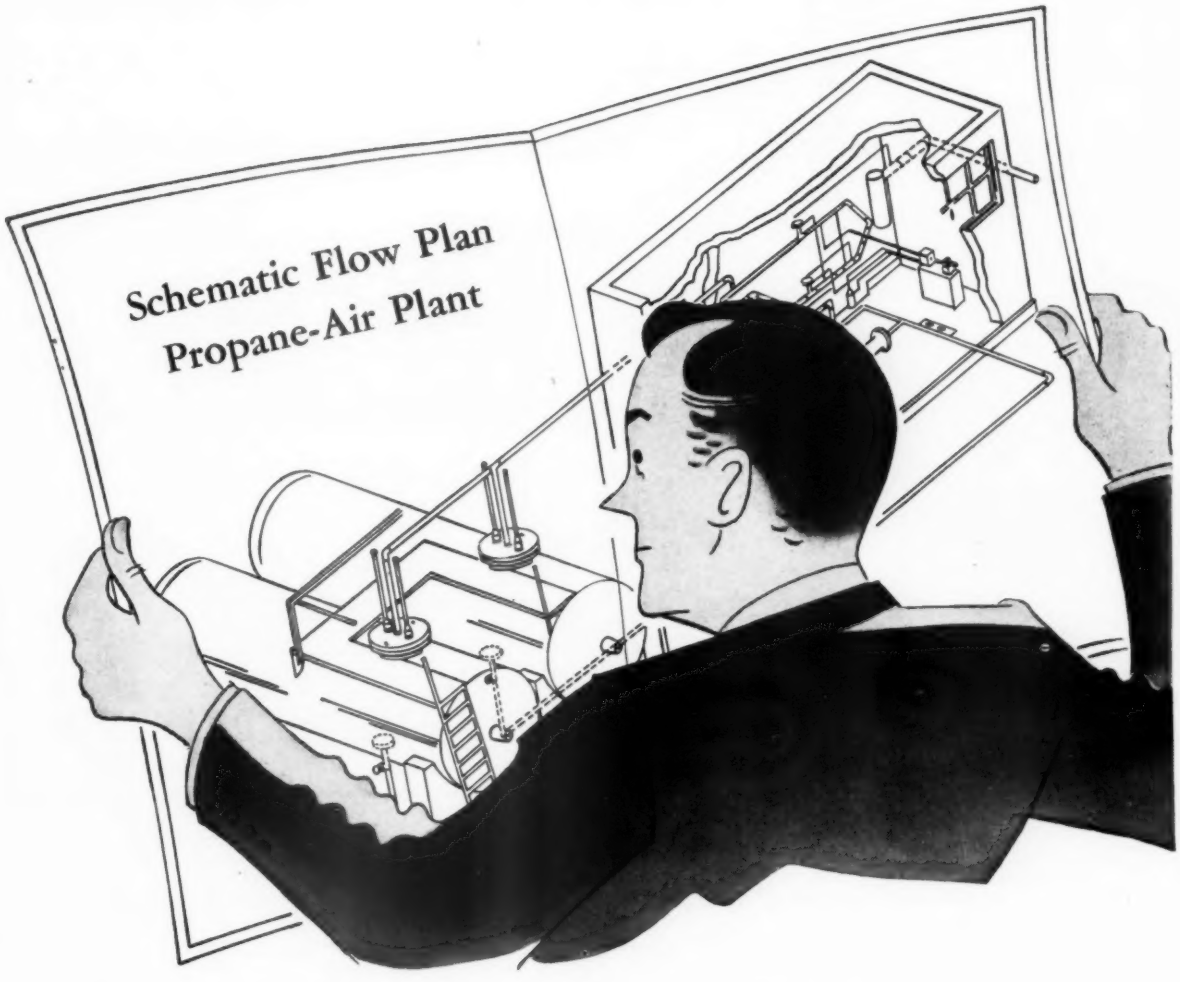

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The Effects and Corrections of Gas Pulsation Problems

By
Foster M. Stephens
Principal Research Engineer,
Development Department,
The Fluor Corporation, Ltd.

THERE are many secondary effects of pulsative gas flow which are usually more easily recognized than the original source itself. One of these is vibration, which is often objectionable in gas compression plants, refineries, gasoline plants, recycling plants, or in most cases where gas, air or steam is being compressed. There seems to be no pressure ranges from vacuum to 5000 lbs. per sq. in., that are free in all instances from line and equipment vibrations. Many factors enter into the degree of pipe vibration, such as type of supports, spacing and whether the system is overhead or on the ground. It likewise has been observed that expansion loops and general piping arrangements may be contributors to excessive vibrational displacements.

Unfortunately, for the sake of pipe and equipment, excessive accelerations, which are a function and measure of vibrational stresses, can often be measured where the piping is securely fastened and there is a minimum of visible shaking present. This has particularly been noticed in some cases where expansion loops are placed horizontally and securely clamped. In many instances the results of the continuous acceleration stresses results in shearing of the bolts in the pipe clamps or shattering of the concrete pipe supports. Usually compressor discharge lines are worse offenders than compressor suction lines as far as mechanical vibration is concerned. There are of course exceptions to this which may be caused by mechanical or acoustical resonance in the suction system.

Effect on Metering

Aside from vibrational effects, pulsative flow is a chief contributor to inaccurate orifice metering, resulting in errors in excess of twenty percent in some instances. Phenomenal cases have even been reported in which the meter showed the gas to be flowing in a reverse direction from the actual flow. These metering errors are often experienced regardless of whether the meter run is located on the suction or the discharge side of the compressor. Remote locations of metering stations from the compressor station does not always solve the metering problem, for there are many times when the pulsative flow is known to be present in the gas stream many miles from the compressor station.

Pressure gage readings fall into the same pressure fluctuating disturbances as meters and there are many instances when it is practically impossible to get an accurate pressure reading in the proximity of a compressor station due to the gage responding to the pressure pulsations.

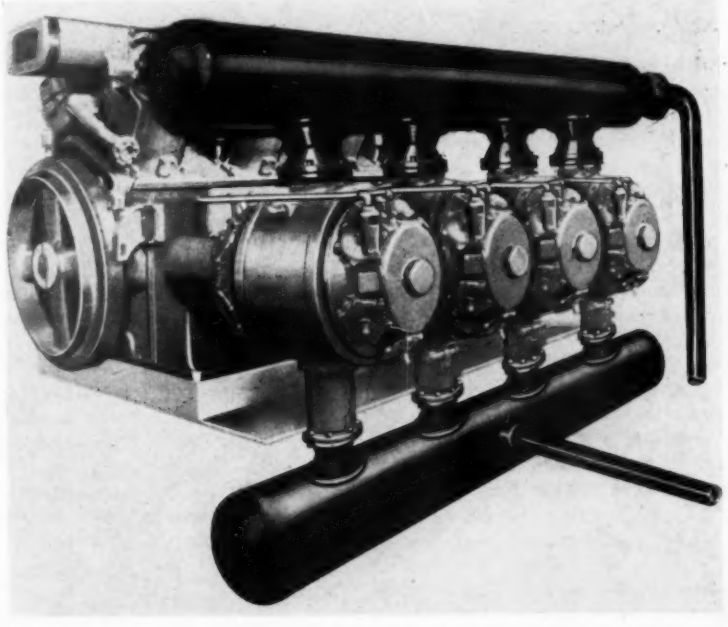
Power Losses

Horsepower loss due to pulsative flow represents an exceedingly complicated story when considered from all angles. On the discharge side, high instantaneous pressures may be produced in compressor cylinders because of discharge line pulsations. This often occurs when several compressors are operating in tandem and discharging into a common header. Likewise reflections can be produced from pipe bends, valves or other abrupt changes in gas flow conditions. The result of this type reflection is again that of high instantaneous peaks.

Another horse power loss is the extra pressure drop required to drive a pulsative flow through a transmission line. Due to the high instantaneous velocities achieved at the pulse peak, the pipe frictional effect is in excess of what would be encountered for a steady flow.

On the suction side of the compressor pulsations can create cylinder starvation at one instant and a supercharged condition the next instant. We have observed cases where engine speed hunting was so bad that it was impossible to operate all engines at the same time.

There naturally have been corrections applied to many of the previously described problems as they appeared in the field, resulting at least



Fluor Pulsation Dampeners installed on both suction and discharge sides of four gas engine-driven compressor cylinders operating in parallel.

in partial solutions to the problem. Many of these corrections have been by trial and error and therefore do not represent a universal solution.

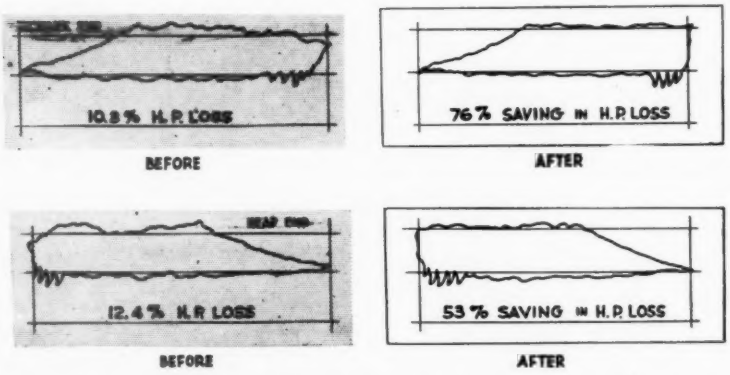
Piping Arrangements

In the case of pipe vibrations, various arrangements of piping have been tried and while it is beyond the scope of this paper it may be said in general that some are decidedly better than others in this respect. The usual procedure when excessive vibration displacements are observed has been to tie down the points of excessive displacements structurally. There have been occasions when this resulted in a shift of the point of maximum displacement to some other part of the piping system, thereby creating the necessity for additional structural supports. In many instances it has been necessary to repeat this procedure several times before the entire problem was corrected. In this connection it should be pointed out that it is virtually impossible to predict and space piping supports in such a manner as to be non-resonant to all the varying frequencies and beat frequencies of pulsation that may result from several compressors running at varying speeds and discharging into a common header. For a single compressor running at fairly constant speed, however, there are certain predictable pipe spans that should be avoided and these can be calculated with a fair degree of accuracy.

Pulsation Dampeners

Another method has been utilized in recent years for decreasing the magnitude of piping vibration. It consists of installing mechanical vibrational dampeners at certain strategic spots in the piping system. These mechanical dampeners have been made in various forms. They usually consist of combinations of weights and springs, weights and rubber, or just springs. The principle employed by these devices is that of changing the natural frequency of the vibrating member or of absorbing the vibrational energy by being resonant to the vibrational frequency. The disadvantages of these devices are that usually they are only a partial cure for the trouble, and require exact location and adjustment to be effective.

To keep metering errors at a minimum, many systems have been used. The simplest of these consists of pinching valves in the meter lead lines. In some instances volume chambers and even orifice plates have been installed ahead of meter runs. To summarize these procedures it may be stated that they at least help to get meter readings that are readable, whereas there are cases that without some type of dampening device it would be impossible to even read the meter charts.



These horsepower indicator cards were made at a large southwestern gas company plant before and after installing Pulsation Dampeners. Considerable horsepower savings were effected on both the crank and head ends of the compressor after pulsative flow was eliminated by the installation.

Volume bottles are quite often installed on both the discharge and suction side of compressors. Their volume often varies over quite a range, depending on the pressure and compression ratio involved. In many instances their cubical contents vary from five to fifteen times the compressor displacement. Their purpose is to minimize the effects of reflections previously mentioned and thereby permit the compressor cylinders to work under the most advantageous conditions, and consequently keep horse power losses at a minimum. In addition to volume bottles the lateral piping is often oversized to add additional volume to the system. Most of these volume bottle installations improve the ill effects of pulsation but in general do not reduce them to a minimum because of the large volumes required to do this. The volume and consequent size required for a satisfactory pulsation reduction in the higher pressure services is extremely uneconomical and is often impractical to locate. Upon occasions resonate conditions have been produced by bottle and lateral sizes where pulsative conditions were more pronounced than would have existed had no partial corrective measure been applied.

Flexible Design

The pulsation dampener, designed on a filter principle, has been universally used to correct pulsation problems and consequently their secondary effects by converting the pulsative flow into a steady flow. The design is sufficiently flexible to allow for either a manifold type for multicylinder service, or an in-line type for single cylinder service. Being a filter device it offers only a high resistance to a pulsative flow and permits a steady gas stream to pass through it with very low pressure drop. In most cases it is practical to design dampeners for a pressure drop of about ½ percent of the operative pressure that are capable of removing in excess of 95% of the pulsation peaks. With the elimination of this high percent of pulsations then it naturally follows that vibration in piping and equipment caused by pulsative flow is eliminated. This means that elaborate hold-down systems, mechanical dampeners, etc., may be eliminated. It also follows that any errors in metering due to pulsations are automatically eliminated by the removal of the pulsations.

Improvement in compressor cylinder conditions by the installation of pulsation dampeners may be divided into two classes which are, namely; installation on discharge and installation on suction side.

Installation of dampeners on the discharge side of compressors results in the removal of pulsations on the high pressure laterals, headers and equipment. The compressor cylinders are naturally working under a more advantageous condition in this instance because there can be no reflections, resonate conditions or standing waves which can create unusual instantaneous pressure conditions within the cylinder during the interval that the discharge valve is open.

(Concluded on page 77)

UGI Equipment

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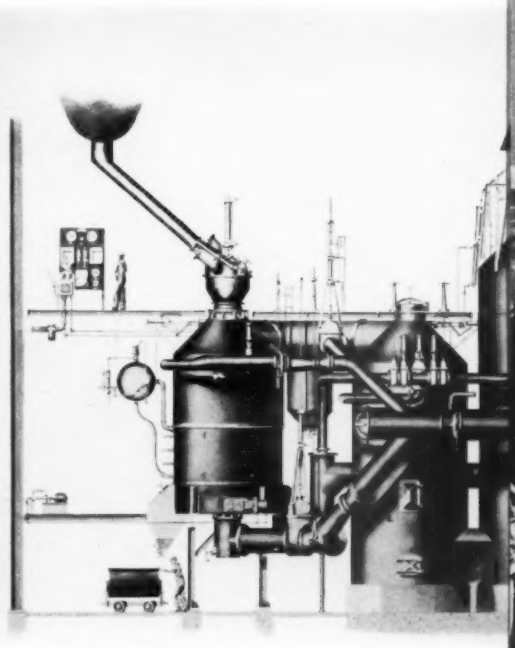

From 1883, when the
built by UGI, until the present day, reser
developing gas-production and gas-hand
utility and industrial gas production. The
the automatic fuel charger, the automatic
the waste-heat boiler — these are only a
introduced into gas manufacture.

UGI apparatus has
shifting economics of raw materials in th
water-gas plant meets the highest standar
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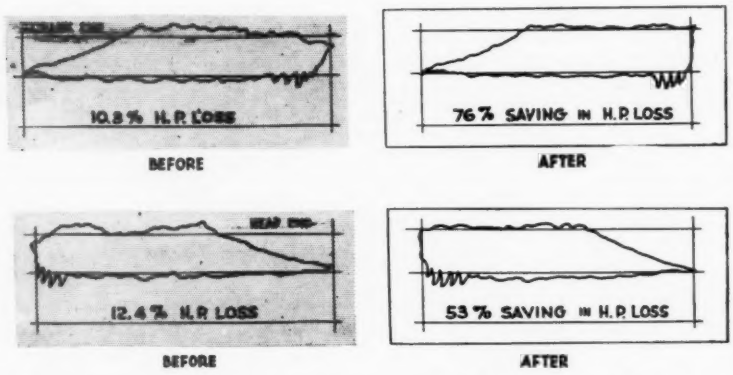

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Installation of dampeners on the discharge side of compressors results in the removal of pulsations on the high pressure laterals, headers and equipment. The compressor cylinders are naturally working under a more advantageous condition in this instance because there can be no reflections, resonate conditions or standing waves which can create unusual instantaneous pressure conditions within the cylinder during the interval that the discharge valve is open.

(Concluded on page 77)

DEVELOPMENTS

IN

GAS PLANT EQUIPMENT

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in partial solutions to the problem. Many of these corrections have been by trial and error and therefore do not represent a universal solution.

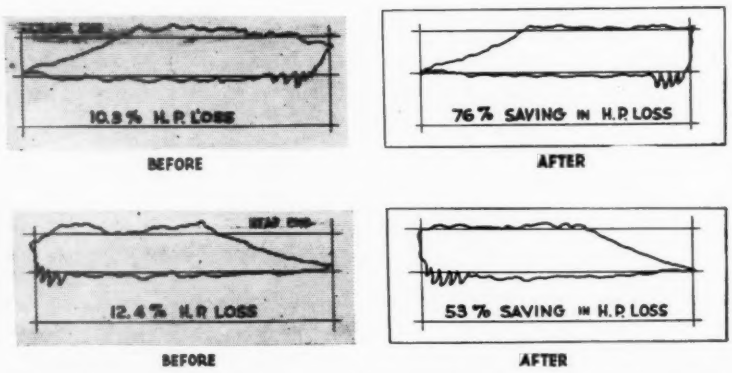
Piping Arrangements

In the case of pipe vibrations, various arrangements of piping have been tried and while it is beyond the scope of this paper it may be said in general that some are decidedly better than others in this respect. The usual procedure when excessive vibration displacements are observed has been to tie down the points of excessive displacements structurally. There have been occasions when this resulted in a shift of the point of maximum displacement to some other part of the piping system, thereby creating the necessity for additional structural supports. In many instances it has been necessary to repeat this procedure several times before the entire problem was corrected. In this connection it should be pointed out that it is virtually impossible to predict and space piping supports in such a manner as to be non-resonant to all the varying frequencies and beat frequencies of pulsation that may result from several compressors running at varying speeds and discharging into a common header. For a single compressor running at fairly constant speed, however, there are certain predictable pipe spans that should be avoided and these can be calculated with a fair degree of accuracy.

Pulsation Dampeners

Another method has been utilized in recent years for decreasing the magnitude of piping vibration. It consists of installing mechanical vibrational dampeners at certain strategic spots in the piping system. These mechanical dampeners have been made in various forms. They usually consist of combinations of weights and springs, weights and rubber, or just springs. The principle employed by these devices is that of changing the natural frequency of the vibrating member or of absorbing the vibrational energy by being resonant to the vibrational frequency. The disadvantages of these devices are that usually they are only a partial cure for the trouble, and require exact location and adjustment to be effective.

To keep metering errors at a minimum, many systems have been used. The simplest of these consists of pinching valves in the meter lead lines. In some instances volume chambers and even orifice plates have been installed ahead of meter runs. To summarize these procedures it may be stated that they at least help to get meter readings that are readable, whereas there are cases that without some type of dampening device it would be impossible to even read the meter charts.



These horsepower indicator cards were made at a large southwestern gas company plant before and after installing Pulsation Dampeners. Considerable horsepower savings were effected on both the crank and head ends of the compressor after pulsative flow was eliminated by the installation.

Volume bottles are quite often installed on both the discharge and suction side of compressors. Their volume often varies over quite a range, depending on the pressure and compression ratio involved. In many instances their cubical contents vary from five to fifteen times the compressor displacement. Their purpose is to minimize the effects of reflections previously mentioned and thereby permit the compressor cylinders to work under the most advantageous conditions, and consequently keep horse power losses at a minimum. In addition to volume bottles the lateral piping is often oversized to add additional volume to the system. Most of these volume bottle installations improve the ill effects of pulsation but in general do not reduce them to a minimum because of the large volumes required to do this. The volume and consequent size required for a satisfactory pulsation reduction in the higher pressure services is extremely uneconomical and is often impractical to locate. Upon occasions resonate conditions have been produced by bottle and lateral sizes where pulsative conditions were more pronounced than would have existed had no partial corrective measure been applied.

Flexible Design

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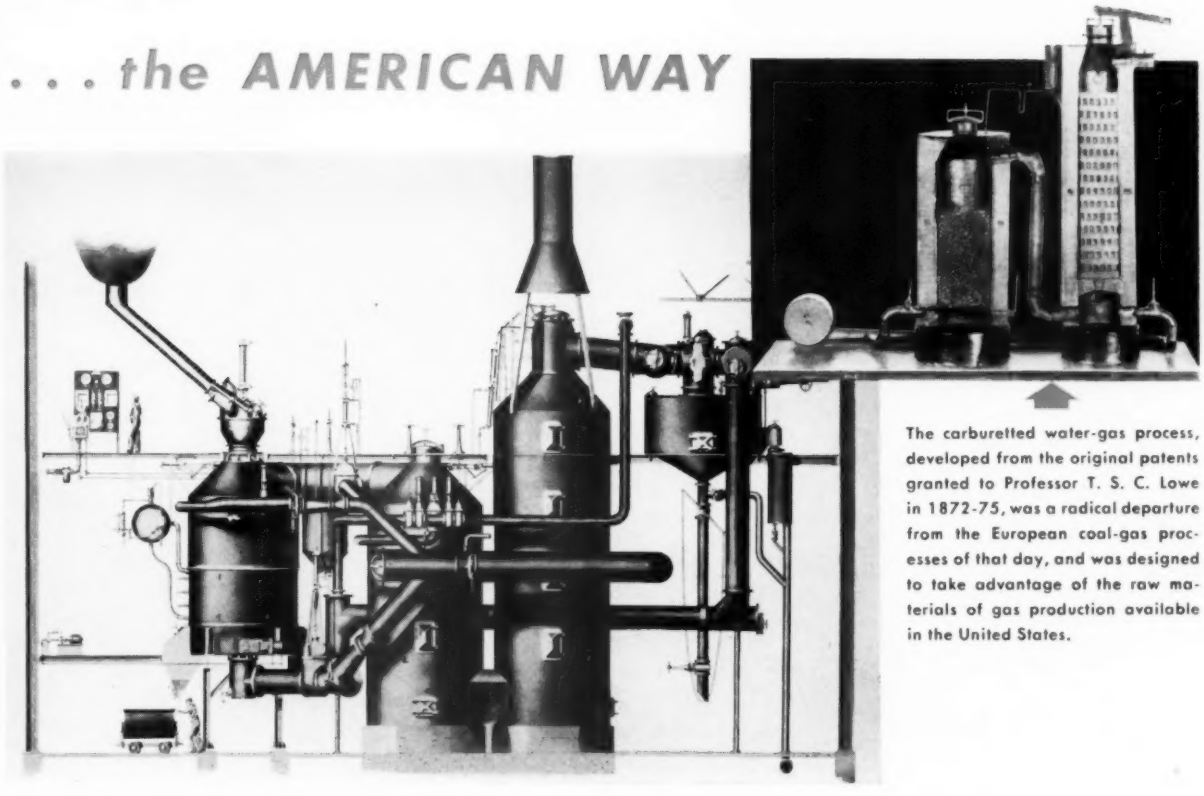
(Concluded on page 77)

UGI Equipment

THE CARBURETTED WATER-GAS PROCESS

. . . the AMERICAN WAY



The carburetted water-gas process, developed from the original patents granted to Professor T. S. C. Lowe in 1872-75, was a radical departure from the European coal-gas processes of that day, and was designed to take advantage of the raw materials of gas production available in the United States.

From 1883, when the first "Lowe" Carburetted Water Gas Apparatus was built by UGI, until the present day, research of UGI and United Engineers has pioneered in developing gas-production and gas-handling equipment to meet the changing conditions of utility and industrial gas production. The self-clinkering mechanical generator water-gas set, the automatic fuel charger, the automatic control machine, the high-duty multipass condenser, the waste-heat boiler — these are only a few of the developments which these companies have introduced into gas manufacture.

UGI apparatus has successfully met the challenge presented by the shifting economics of raw materials in this country. The modern, fully-automatic carburetted water-gas plant meets the highest standards of American engineering. It is adaptable to many different fuels and can produce gases of widely different composition to meet public-utility and industrial requirements. Today, carburetted water gas is being made with coke, bituminous and anthracite coal, gas oil, heavy oils, crude oils, propane, butane, refinery gas, and natural gas.

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An Apparatus for the Determination Of Organic Sulphur Compounds In Manufactured Gas

By

I. J. W. MacHattie* and N. L. McNiven**

WITH increasing interest in the reduction of organic sulphur, the determination of the organic sulphur compounds in manufactured gas has become an analysis of considerable and growing importance. At present the organic sulphur compounds are believed to consist almost entirely of mercaptans, thiophene, carbon disulphide and carbon oxysulphide. Methods for the determination of some or all of these constituents have been published by Hutchison (1), Riesz and Wohlberg (2), Kemper and Guernsey (3), Shaw (4) and Martin, Rueck, Knaggs and Hakewille (5). Of the different compounds, mercaptans can be determined directly by absorption and analysis of the absorpting solution. The others are best determined indirectly by the use of suitable selective absorbents combined with the estimation of the residual sulphur content by burning the gas and absorbing the sulphur oxides formed. The difference between total sulphur, also determined by combustion, and the residual sulphur, then gives the concentration of sulphur due to the organic sulphur compound or compounds in question. For the simultaneous estimation of all four constituents, as is essential in plant analyses where the concentration and composition of the organic sulphur fraction may change considerably from hour to hour, four analysis units are needed, three of which require burners for the final combustion of the gas samples.

The present article describes an apparatus which was designed for the simultaneous determination of the known organic sulphur compounds in coal gas and carburetted water gas at the plants of The Consumers' Gas Company, Toronto. The design and arrangement of the different items together with the method of operation are believed to contribute to increased simplicity of an essentially complicated procedure without undue sacrifice of accuracy.

* Research Chemist, Division of Chemical Research, Ontario Research Foundation, Toronto, Canada.

** Research Fellow in Gas, Division of Chemical Research, Ontario Research Foundation, Toronto, Canada.

Presented at the 39th Annual Convention, Canadian Gas Association, Murray Bay, Quebec, June 18-19-20-21, 1946.

Selective Absorbents

The absorbing solutions for the different sulphur compounds are as follows:

(a) Sulphur Oxides

One per cent hydrogen peroxide solution is used to absorb the sulphur oxides from burner flue gases. It is prepared by diluting one part by volume of 30% hydrogen peroxide with 30 parts by volume of water. This solution is an efficient absorbent for sulphur oxides and very easy to prepare and handle. As made up, the solution is slightly acid and need not be further treated if the determination is to be completed gravimetrically. The sulphuric acid formed can also be determined volumetrically by titration with standard alkali.

(b) Mercaptans

Mercaptans are absorbed by the cadmium chloride reagent recommended by Shaw. The reagent is prepared as required by adding 10 ml. of 1 N sodium carbonate to 60 ml. of a 10% solution of cadmium chloride. Hydrogen sulphide is also absorbed while thiophene, carbon disulphide and carbon oxysulphide are not affected.

(c) Thiophene

Concentrated sulphuric acid followed by sodium carbonate solution, as recommended by Hutchison (1) and Siesz and Wohlberg (2), is used to absorb thiophene. Carbon disulphide and oxysulphide are unaffected by these reagents. From the reports of these investigators it is evident that concentrated sulphuric acid also absorbs a considerable proportion of the mercaptans in the gas. Hence, for low mercaptan concentrations, say, less than 0.5 gr. per 100 cu. ft. it may be considered, without introducing a significant error, that the sulphuric acid absorbs all the mercaptans. The use of a separate scrubber for the removal of mercaptans is thus avoided in many determinations. The purpose of the sodium carbonate is to trap any acid spray or acidic sulphur oxides which may be evolved. A 1 N solution is employed in the present apparatus.

(d) Carbon Disulphide

Carbon disulphide is removed by passing the gas countercurrent through an oil scrubber. Standard grade kerosene of the following specifications is used as the scrubbing medium:

Gravity	46° Bé
Flash Point	142° F.
Viscosity at 60° F.	330 S.S.U.
Sulphur	0.02%
Distillation Range	360-500° F.

Tests with purified hydrogen showed no significant pick-up of sulphur compounds from the kerosene.

Thiophene is completely absorbed and mercaptans are partially absorbed at the scrubbing rates used to remove carbon disulphide. As in the case of the concentrated sulphuric acid, for low mercaptan concentrations the scrubbing procedure may be considered to remove all of the mercaptans without causing serious error. The amount of carbon oxysulphide dissolved by the kerosene is relatively slight. If desired, a correction based on the work of Hutchison (1), may be applied.

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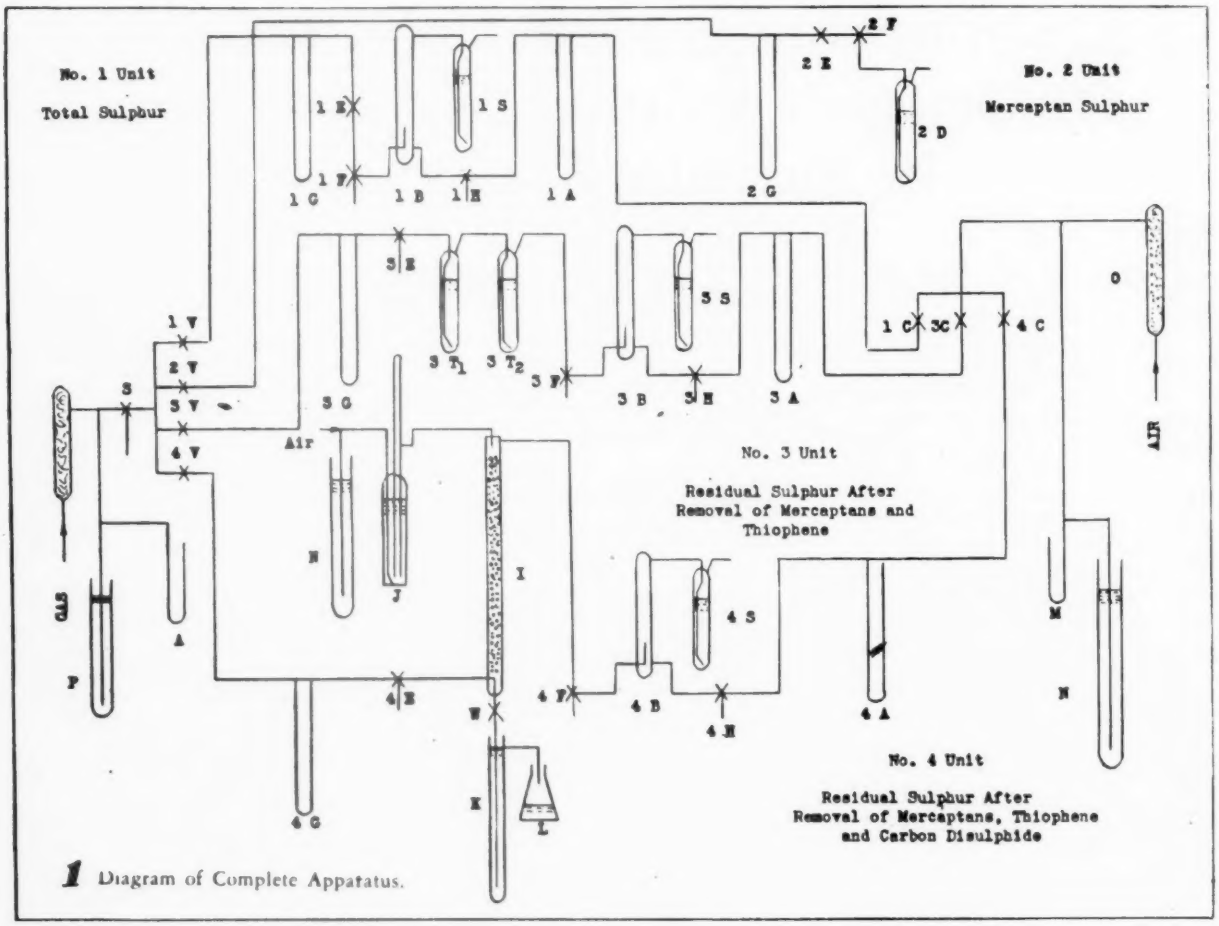
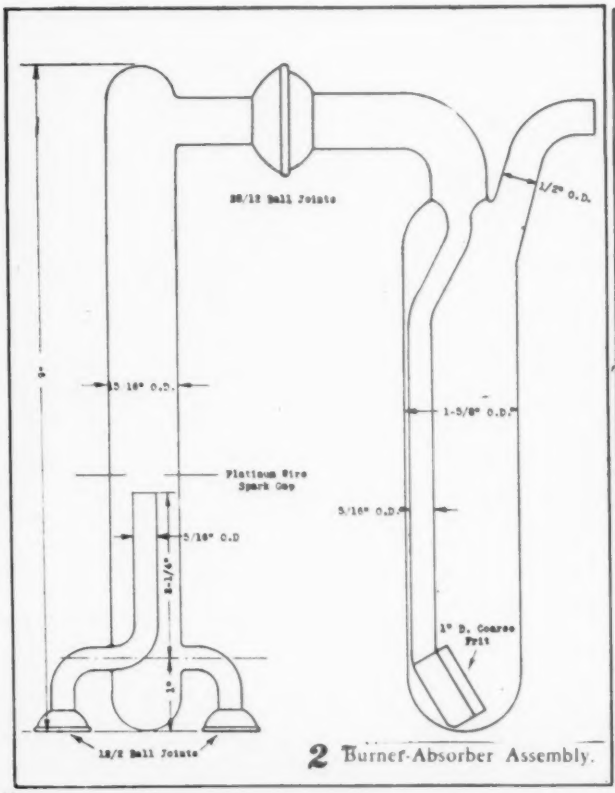
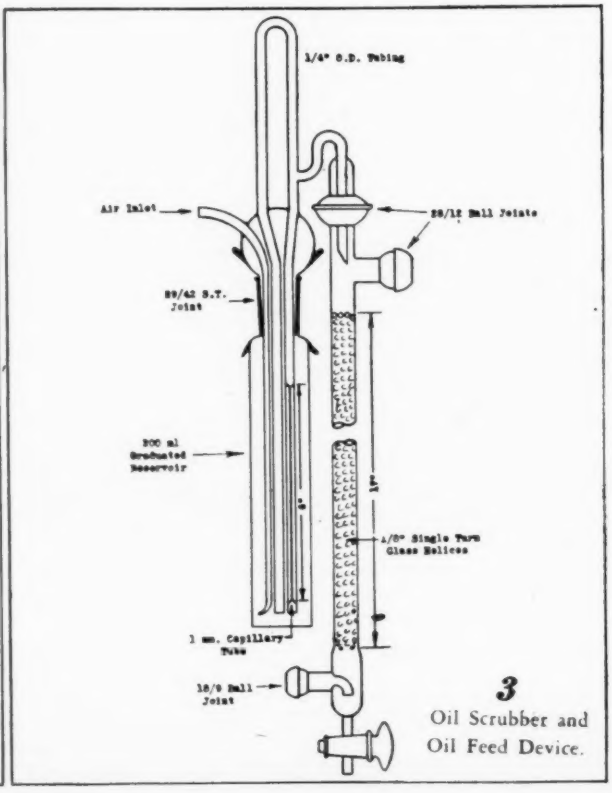


1 Diagram of Complete Appatatus.



2 Burner-Absorber Assembly.



3 Oil Scrubber and Oil Feed Device.

tem. A 5-gallon reservoir was used in earlier experiments between the pump and the apparatus to smooth out minor fluctuations in pressure but this has since been found unnecessary. From the pump the gas passes through glass wool filter Q to three-way stopcock S and the distribution manifold.

Flexible black Irv-O-Lite tubing (Type XTE-130) connects the analysis units to the distribution manifold where stopcocks 1 V, 2 V, 3 V and 4 V serve as on-off controls for the admission of gas.

Air for combustion is drawn from a 100 cu. ft. compressed air cylinder and purified by passage over ascarite in tube O. Tests with purified hydrogen showed this method of purification to be satisfactory. Constant air pressure is assured by the sulphuric acid seal H. Stopcocks 1 C, 3 C, 4 C, are the on-off controls for the admission of air to the burners. Saran and Irv-O-Lite tubing are also used here to make the connection from tank to distribution manifold and from the stopcocks to the burners.

The analysis units are constructed entirely of Pyrex glass with standard taper or ball joints to provide the required flexibility. The flow of gas in each unit is controlled by adjustment of stopcocks 1 E, 2 E, 3 E, and 4 E and measured by capillary flowmeters 1 G, 2 G, 3 G, and 4 G. To purge the units, three-way stopcocks 1 F, 2 F, 3 F and 4 F are provided. Air to the burners is metered through capillary flowmeters 1 A, 3 A and 4 A and controlled by three-way stopcocks 1 H, 3 H and 4 H. Mercaptans are absorbed in scrubber 2 D which complete analysis Unit 2. Thiophene is removed in absorbers 3 T_1 and 3 T_2 while the oil scrubber for the removal of thiophene and carbon disulphide is composed of sulphide acid seal N, oil feed J, the scrubber I, drain stopcock W and the receiver made up of K and L. The burner-absorber assemblies 1 B, 1 S, 3 B, 3 S, 4 B and 4 S complete analysis units 1, 3 and 4.

Calibration of the flowmeters is readily accomplished by connecting a wet test meter to 1 F, 2 F, 3 E and 4 E in the case of the gas flowmeters, and to 1 H, 3 H and 4 H in the case of the air flowmeters. In calibrating, care should be taken that the gas or air is bubbling out the appropriate seal and that the flow is controlled in the same manner as during the analysis. The calibrated values are expressed in cu. ft. per hour, saturated, 60° F. 30 in. Hg.

Details of the burner-absorber assembly are shown in Fig. 2. It will be noticed that no primary air is added to the gas. A comparison was made between this type of burner and a bunsen type which gave a non-luminous flame but no significant difference in results was observed and the non-aerated burner was chosen for its greater simplicity. These burners are being used on manufactured gases with calorific values ranging from 450-550 B.T.U. per cu. ft. Possibly for higher calorific values, the addition of primary air would be required. The platinum wire spark gap serves to ignite the gas when a vacuum Tester (Fisher Scientific Co. 1-179) is applied to one of the electrodes.

The efficiency of the absorbers in removing sulphur Oxides from the flue gases was found to be 98% or better. The coarse frits throw a back pressure of 0.8 in. Hg. when the combustion products are passing through.

The absorber used for mercaptans (2 D) is similar in design to the absorber for the sulphur oxides but has a finer frit with a back pressure of 2.4 in. Hg. at a flow rate of 0.5 cu. ft. per hr. The designs of the flowmeters and thiophene scrubbers are shown in Figs. 4 and 5 respectively and require no special comment except to note that the porosity of the frit in the thiophene absorbers is much the same as the mercaptan scrubber. The nature of the oil scrubber and oil feed will be clear from Fig. 3. Successful operation of the oil scrubber depends upon a supply of air at constant pressure which is achieved in the present case by keeping the air bubbling through seal N.

For gases containing a significant concentration of mercaptans and/or hydrogen sulphide it would be necessary to enlarge the apparatus by including another absorber in units 3 and 4 which could be filled with cadmium chloride reagent to ensure the removal of these compounds.

(b) Operation

To make a test, the compressor is started and the pressure adjusted by means of a by-pass on the pump until the gas is bubbling freely through mercury seal P. Absorber 2 D is charged with 60 ml. of cadmium chloride reagent and 10 ml. of 1 N sodium carbonate and absorbers 1 S, 3 S and 4 S with 70 ml. of 1% hydrogen peroxide solution; Absorber 3 T_1 is filled with 45 ml. of concentrated sulphuric acid and 3 T_2 with 45 ml. of 1 N sodium carbonate solution. The oil feed is started at a rate of approximately 80 ml. per hour. The units are purged by turning 1 F, 2 F, 3 F and 4 F to the purge position opening 1 V, 2 V, 3 V and 4 V and adjusting 1 E, 2 E, 3 E and 4 E to give a rate of flow of about 0.5 cu. ft. per hour. Ten minutes or so before the end of the purge the air is turned into the burner-absorber assemblies at a rate of 3.0 cu. ft. per hr. which gives about 50% excess air in the flue gases. After purging for 30 minutes, the gas is turned into absorber 2 D and then successively into 1 B, 3 B and 4 B, the flame being ignited a few seconds after the stopcock is turned on. After a little experience the four units can be started up in well under a minute. In the first few minutes the gas rates are adjusted to a value in the range 0.4 to 0.5 cu. ft. per hour and the oil feed to give a scrubbing rate of 200 ml. per cu. ft. sample. Flowmeter readings are taken at 10-minute intervals starting 5 minutes after the commencement of the test. The rate of oil feed is also checked every 10 minutes. Tests have shown that variations up to 10% in the rate of oil feed are of no significance. The usual time for a test is from 1-2 hours. The units are shut down by turning off stopcocks 2 V, 1 V, 3 V and 4 V successively.

The calibration of the gas flowmeters is checked at least once a day when testing the same type of gas and more frequently if changes in gas quality are suspected.

Determination of Total and Residual Sulphur

Once the gas is shut off at the end of the run, the contents of absorbers 1 S, 2 S and 3 S plus rinsings are transferred to beakers heated to boiling and sulphate precipitated by adding 10 ml. of 10% barium chloride solution slowly. After standing for at least two hours the barium sulphate is filtered off, ignited and weighed. The average flowmeter readings and duration of test are combined to give the corrected volumes of the gas samples. The concentration of total sulphur from Unit 1 and residual sulphur from Units 3 and 4 is then calculated by the relation

$$\text{Gr. sulphur per 100 cu. ft.} = \frac{(\text{g. } BaSO_4 - \text{g. Blank}) \times 0.1374 \times 100 \times 15.4}{\text{Corrected volume in cu. ft.}}$$

The average blank amounts to about 0.0015 g.

Total and residual sulphur may also be determined volumetrically by adding methyl red indicator to the

original 1% hydrogen peroxide solution, purging with CO_2-free air and adjusting the solution just to the alkali yellow colour of methyl red. When the test is finished the contents of the absorber are transferred to a beaker, and fresh methyl red added. The solution is purged with CO_2-free air and titrated with 0.01 N sodium hydroxide to the original end-point. In this case,

$$\text{Gr. sulphur per 100 cu. ft.} = \frac{\text{Ml. alkali} \times \text{N alkali} \times 0.0160 \times 15.4 \times 100}{\text{Corrected volume in cu. ft.}}$$

A number of total sulphur tests were made in which the volumetric was compared directly with the gravimetric method by first performing the one analysis then the other on the same solution. The results by the volumetric method were on the average about 5% higher than those obtained gravimetrically. The chief advantage of the volumetric method is that results can be obtained quickly and checked later by the gravimetric method if the greater accuracy of the latter is required.

Determination of Mercaptan Sulphur

Absorber 2 D is disconnected and cooled to at least 10° C. in ice water. Ten ml. of concentrated hydrochloric acid are added through the joint and the absorber is shaken gently until the solution is free of precipitate. Ten ml. of 0.01 N iodine solution, measured accurately by an automatic pipette are next added and the absorber shaken for a minute. Excess iodine is then titrated with accurately standardized 0.01 N sodium thiosulphate solution. A similar procedure is carried through on a blank solution and the difference between the two titrations with thiosulphate measures the equivalents of iodine consumed in the reaction with sulphides and mercaptides. Mercaptan sulphur is calculated on the basis that one atomic weight of iodine is equivalent to one atomic weight of sulphur combined as mercaptans.

$$\text{Gr. mercaptan sulphur per 100 cu. ft.} = \frac{(\text{Ml. thio for blank} - \text{ml. thio for sample}) \times \text{N thio} \times 100 \times 0.032 \times 15.4}{\text{Corrected volume in cu. ft.}}$$

Hydrogen sulphide interferes since it is also absorbed and each atom of sulphur present as hydrogen sulphide is equivalent in the reaction with iodine to two atoms of mercaptan sulphur. For low mercaptan concentrations as calculated above, the interference is not significant since the chief importance of the determination is to establish the fact that the combined concentration of hydrogen sulphide and mercaptan is negligible. If it becomes necessary to differentiate between hydrogen sulphide and mercaptans the differential titration method of Shaw (4) is available.

Calculations

The sulphur due to the different organic sulphur compounds is calculated as follows. All concentrations are to be understood as expressed in grains per 100 cu. ft.

(a) Mercaptan Sulphur

The calculation is shown in the preceding section.

(b) Thiophene sulphur

Thiophene sulphur = Total sulphur — mercaptan sulphur — residual sulphur from Unit 3.

(c) Carbon Oxysulphide Sulphur

$$\text{Carbon oxysulphide sulphur} = \frac{(\text{residual sulphur from Unit 4}) \times 100}{92}$$

The correction factor is that suggested by Hutchison.

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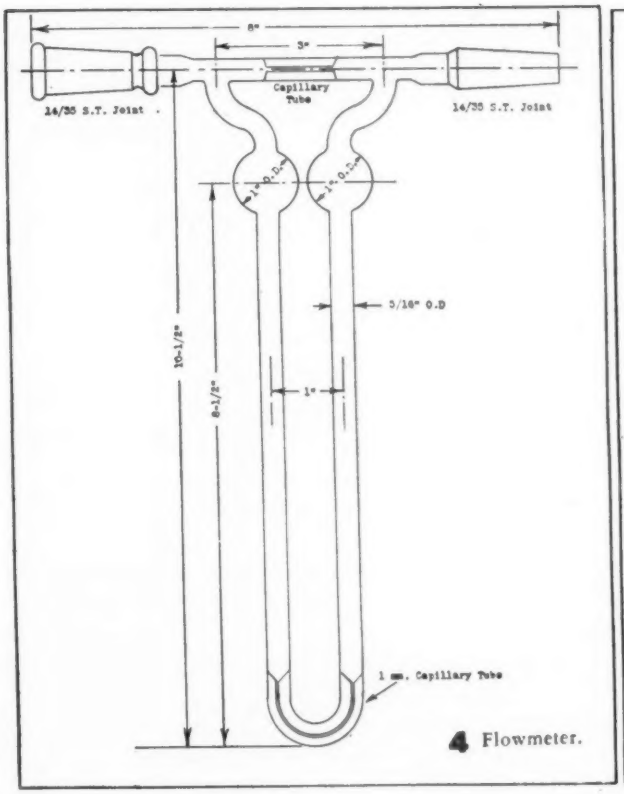
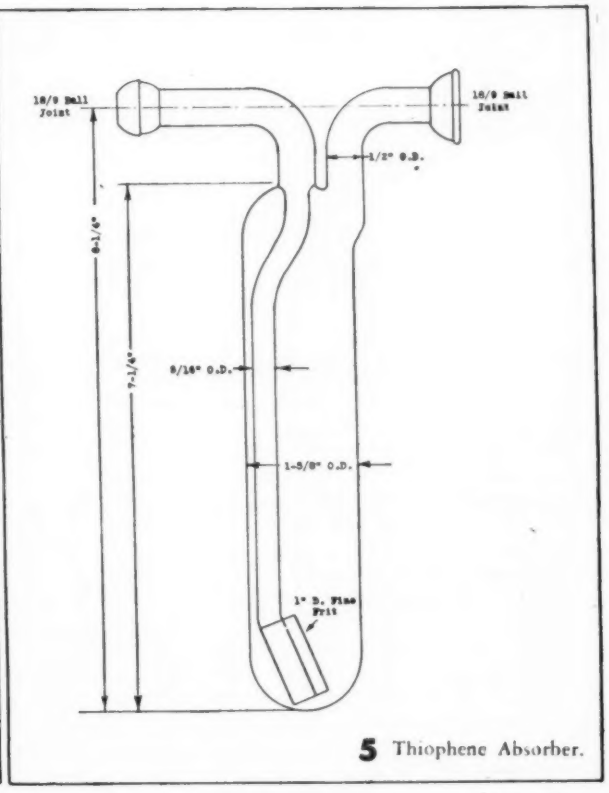
200 S. Second St., Elizabeth 1, N. J. 54 Bouchet St., Los Angeles 12, Calif.
3154 S. California Ave., Chicago 8, Illinois



4 Flowmeter.



5 Thiophene Absorber.

(d) Carbon Disulphide Sulphur

Carbon disulphide = Residual sulphur from Unit 3—Carbon oxysulphide sulphur.

Some Results

The following results were obtained on coal gas from steamed vertical retorts and indicate the nature of the tests which have been made so far with the apparatus:

The accuracy with which sulphur can be determined in the gas by combustion depends to a certain extent upon the volume of sample and the sulphur content. For 0.5 cu. ft. samples containing about 15 gr. per 100 cu. ft. the accuracy is estimated at ±0.2 gr. The precision of the mercaptan sulphur determination is estimated at ±0.1 gr. for a 0.5 cu. ft. sample.

Sulphur (gr. per 100 cu. ft.)

Run No.	Total	Mercaptans	Thiophene	Carbon Disulphide	Carbon Oxysulphide
7	15.1	0.6	3.0	7.2	4.3
13	15.6	0.5	2.5	8.0	4.6
14	15.0	0.5	2.2	8.2	4.1

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(1) Hutchison, W. K. Institution of Gas Engineers, Publication No. 175/64, p. 37.
(2) Riesz, C. H., and Wohlberg, C. Report of Gas Conditioning Committee, Am. Gas Assoc., 1943, p. 4.
(3) Kemper, W. A., and Guernsey, E. W. Am. Gas Assoc. Proceedings 1942, p. 364.
(4) Shaw, J. A. Ind. Eng. Chem. Analytical Edition 12, 668 (1940).
(5) Martin, S. W., Rueck, E. M., Knaggs, E. A., and Hakewill, H. Project No. CS-1.2 Report No. 28 to Organic Sulphur Sub-Committee American Gas Association, April 9, 1945.

The Utilization of North Dakota Lignite

As part of a cooperative research program designed to utilize North Dakota lignite in the beneficiation of low-grade iron ores of Minnesota, the Bureau of Mines has demonstrated that both lignite and subbituminous coal yield reducing gases suitable for beneficiating iron ores as well as for the commercial production of industrial hydrogen or for the manufacture of synthetic liquid fuels and a host of chemicals, Dr. R. R. Sayers, Director of the Bureau, reported to Secretary of the Interior J. A. Krug.

Although these lower rank fuels have been considered inferior for most industrial purposes, lignite and subbituminous coal possess certain advantageous physical and chemical properties for gasification purposes that higher-rank fuels do not have.

Control of furnace temperature and rate of steaming proved to be important factors in the production of good quality water gas from lignite and subbituminous coal, according to a summarized progress report covering work accomplished in the carbonization and gasification of these fuels during 1944, now available for free distribution.

The carbonization and gasification of these fuels which represents further progress in the analysis and utilization of American coals have been conducted by the Bureau of Mines under a cooperative agreement with the University of North Dakota at Grand Forks, N. Dak., and the Colorado School of Mines, at Golden, Colo., with considerable additonal laboratory and test work in the Bureau's Central Experiment Station at Ptitsburgh, Pa.

A copy of Report of Investigations 3901, "Gasification of Lignite and Subbituminous Coal, Progress Report for 1944," may be obtained free by writing to the Bureau of Mines, Department of the Interior, Washington 25, D. C.

Con. Edison Co. Announces Staff Appointments

Frank J. Bischoff, who has been controller of Consolidated Edison Company of New York, Inc., for the past twenty-three years has been elected a vice-president of the Westchester Lighting Company, which is part of the Consolidated Edison System.

Charles E. Eble was elected controller of the Consolidated Edison Company and was also appointed controller of the New York Steam Corporation.

John V. Cleary, appointed senior assistant controller of Consolidated Edison and will be in charge of the company's general accounting department.

Arthur E. Hald will become auditor on October 1. He has been manager of the auditing department since 1941. B. S. Rodey, associate controller, has been placed in charge of the company's tax department.

Close Inventory Control In a Centralized Operation

By
F. A. Jaxtheimer
Chief Clerk
The Peoples Natural Gas Company
Pittsburgh, Pa.

CLOSE INVENTORY control at minimum cost and with maximum speed and ease would seem to stand out as the primary objective of any material accounting system.

Our material accounting methods have been tested by widely-varying conditions over a number of years. We feel we can claim, with justifiable pride, to have attained the desired goals.

A large part of the credit goes to mechanization of the work. We found through experience that manual methods failed to provide the results we needed, cost too much, and lacked speed and accuracy. Even if our old pen-and-ink methods would work today—which we doubt—they would probably require at least three times as much operating personnel in our material accounting section because of increased volume. With skilled help scarce, this would be very nearly a hopeless situation.

It seems almost incredible now that we once priced our material requisitions by hand and then posted the warehouse ledger as an additional step. Today, our requisitions are priced, extended and totaled by machine at the same time that the stock ledger is posted and proved.

We can't imagine operating without accurate, up-to-date information on the extent and distribution of the stock on our twenty-seven warehouses. Yet, more often than not, that was the condition with pen-and-ink.

By way of introduction to The Peoples Natural Gas Company, you should know that we serve some 186,000 customers in western Pennsylvania and that we are a subsidiary of Consolidated Natural Gas Company, New York City. We maintain five field warehouses, four pump station warehouses and eighteen city plant warehouses. Our warehouse ledger, at last count, contained in excess of 13,000 individual record cards bearing complete information on the movement of probably 15,000 to 20,000 items "in" and "out" of stock.

A centralized stock record plan, such as we use, appeals to us as providing a greater degree of control and as permitting use of the most economical mechanical methods of pricing and posting—methods not so practical on the small-scale, individual district basis. Our district records consist of control cards showing receipts, disbursements and quantities on hand.

Requisition Form

Basically, we use a multiple-item type of material requisition, but, by means of a rather unique form arrangement, we also enjoy certain benefits of a unit type requisition.

When written in the field, the requisitions are in multiple-item form. When we receive them, we cut the carbon copies into strips containing one item each but retain the original copy intact. The strips are stuffed into the ledger trays in front of the ledger cards to which they will be posted. After the posting has been completed, the extensions printed on the strips by our typewriter-accounting machines are recapped on the same machines to the original copy of the form, thus consolidating the completed data in multiple-item form (see illustration).

The advantages of this procedure can be readily seen. Multiple-item forms, by their nature, can be written up faster than can unit forms. Therefore, it is desirable to provide the warehouses with the multiple-item type of requisition. At the same time, when we begin ledger posting, we want to be able to make a straight run through the ledger. That can be done only if you have requisitions that can be broken down by items and placed with their corresponding ledger cards. Then, for final disposition of the information we again want a multiple-item requisition because it is much easier and better to file with vouchers than are unit requisitions.

All material removed from warehouse for original installation and for repair is drawn out on work orders. The district work orders arrive in our material accounting section unpriced and unextended. At this stage, they are simply a record of quantity and type of items drawn for use on different jobs.

By the method outlined three paragraphs ago, the information the work orders contain arrives in the ledger trays in posting position. This information is posted to the warehouse stock ledger cards on machines that prove and total the entries as a by-product of posting them. The individual item strips are inserted in the machine, posted and removed as the various work order items are posted to the various ledger cards and a journal sheet. Automatically-accumulated totals of value are posted to the various district control cards and are printed on the journal sheet by districts.

Mechanical Multiplication

The multiplication performed in this operation is entirely mechanical. The operator enters the two factors (quantity and price) in the machine, and the extension is made by direct multiplication. Thus, we obtain maximum speed and streamlining of procedure on credit entries—where it is needed most. About 70% of our total posting time is devoted to credits for the obvious reason that, while material is purchased in relatively few transactions of large quantities, it is disbursed in numerous transactions of small quantities.

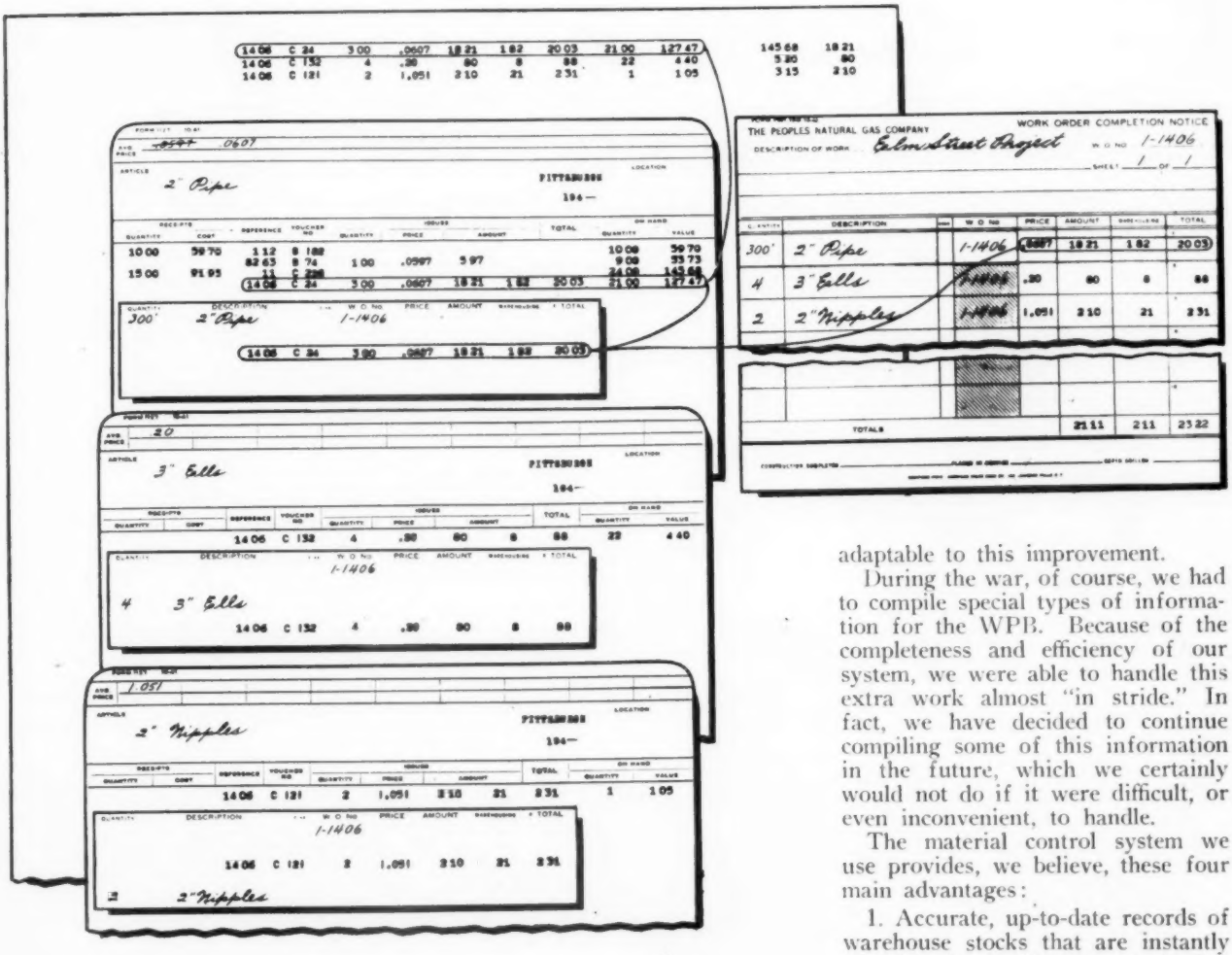
The strip requisitions are then sorted back according to work orders and are recapped to the original copy of the work order. Totals are printed by the machine at the bottom of each work order. This copy of the work order, then, becomes a complete record of the stock issued and is vouchered and filed.

Debit Items

Debit items arise from three main sources: (1) retirement orders for material returned to stock from abandoned installations, (2) transfer orders covering material transferred from other district warehouses, and (3) material purchase orders.

The retirement order actually has two sections. The upper section represents material flowing into stock from abandoned installations — the debit just mentioned. The lower section shows material used in abandonment operations—a credit to the stock ledger.

The debit items are extended on calculators and the total written at the bottom of that section. Just as with the work orders, the carbon copies of the retirement order are



then cut into strips and stuffed in the trays for posting to the ledger. Grand totals are accumulated by districts. The credit items are processed exactly like those on the work orders.

Transfer order debits are processed in the same manner as retirement order debits, as are material purchase debits.

Method of Pricing

We use an average method of pricing and adjust prices twice each month when posting the debits. Up until three years ago, we made quite a job of calculating average prices. One day we tumbled to the fact that there was a much easier way to do it We already had accounting machines equipped with direct multiplication and, by the application of reciprocals, we could determine average prices quickly and easily on those machines. We obtained reciprocal tables and now make our price adjustments in far less time than before.

After all debit and credit postings for the month have been completed, a tape of ledger card balances is run according to districts. This tape is balanced with each district's control card, and the total for all districts is posted to the master control card. Balancing to the penny with the Warehouse Control account in the General Ledger is accomplished with very little difficulty.

A Flexible System

We have found our equipment sufficiently flexible to absorb a sizeable increase in volume of work since it was originally installed. Our present-day volume is easily twice what we had when we changed systems. Our four machines are not kept busy all the time, and we have no doubt that further increase could be absorbed, if that were necessary.

Another phase of our system's flexibility is that changes in requirements—both those introduced by us and by outside sources—have been met with minimum difficulty.

We developed the strip form just prior to the war because we felt that it provided a faster, more efficient way of handling data. We found that our accounting machines were easily adaptable to this improvement.

During the war, of course, we had to compile special types of information for the WPB. Because of the completeness and efficiency of our system, we were able to handle this extra work almost "in stride." In fact, we have decided to continue compiling some of this information in the future, which we certainly would not do if it were difficult, or even inconvenient, to handle.

The material control system we use provides, we believe, these four main advantages:

1. Accurate, up-to-date records of warehouse stocks that are instantly available for verification of physical inventories.

2. Combining of related records and steps into single operations. We like the idea of pricing, extending, totaling and proving requisitions at the same time that we post, total and prove the warehouse stock ledger.

3. Reduction of control procedures to a well-ordered routine requiring a minimum of accounting personnel and a minimum of cost.

4. Sufficient flexibility to meet changing conditions and volumes.

Brewer Re-elected Treasurer

O. W. Brewer, secretary of the American Gas Association, New York City, has been re-elected treasurer of the Controllers Institute of America, and O. H. Ritenour, controller of Washington Gas Light Company, Washington, D. C., has been chosen as director of the same organization. This action took place at the Fifteenth Annual Meeting of the Institute, held September 15-18 in the Hotel Commodore, New York City.

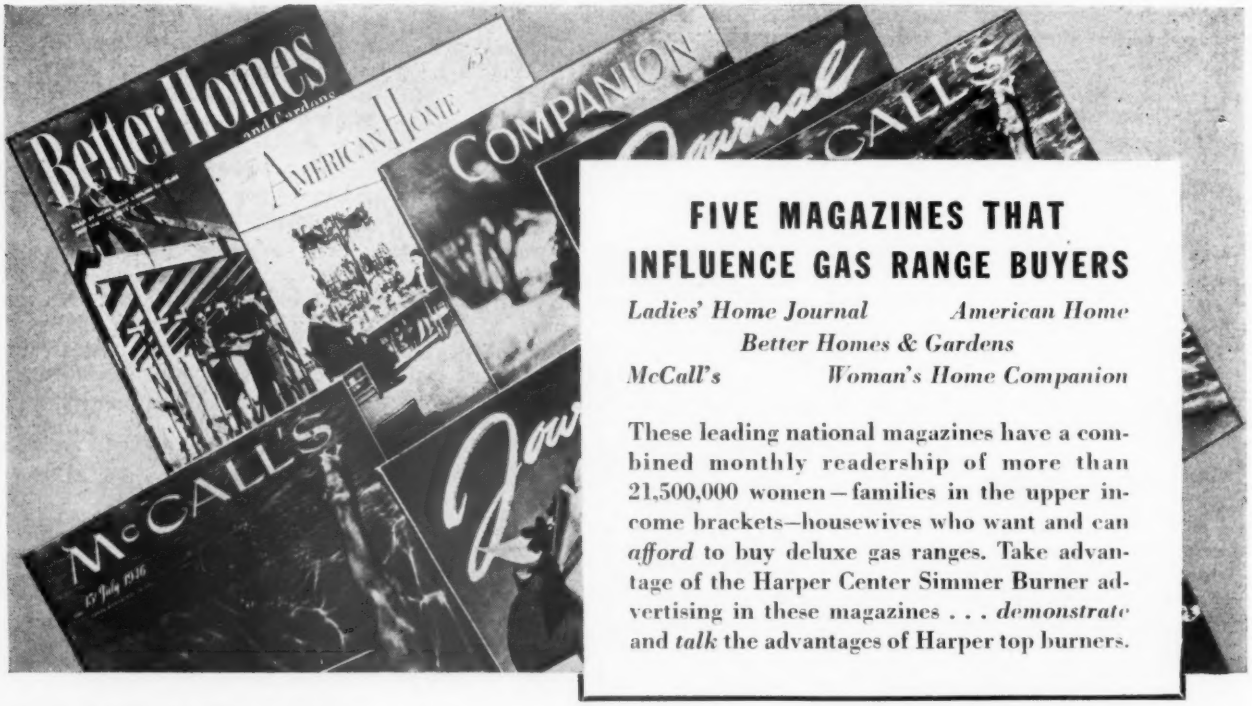
The Institute is a technical and professional organization of controllers devoted to the improvement of controllership procedure.

This booklet identifies ranges equipped with the **HARPER CENTER SIMMER BURNER**

A STOCK QUESTION being asked by more and more women when they set out to buy a new gas range is, "Has it got the Harper Center Simmer Burner?" That's the cue for your sales-here, which is put in every Harper man to produce the booklet shown equipped range when it leaves the factory.

Our consumer advertising is telling prospective range buyers to look for this identifying booklet. It also points out that the famous Harper "2 burners in 1" Center Simmer Burner saves up to 39% on gas, keeps kitchens up to 9 degrees cooler, saves hours of kitchen pot-watching weekly, and has many other advantages possessed by no other top-burner.

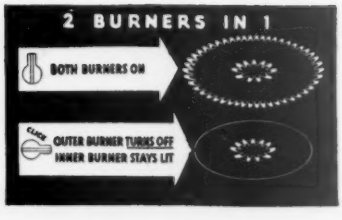
To trade-up your customers to a higher priced range, *demonstrate* these advantages. We offer you a special FREE booklet, "How to Sell More Gas Ranges," which contains a series of quick, convincing floor demonstrations planned to dramatize the advantages of the modern gas range. Send for copies for your salesmen. Harper-Wyman Company, 8562 Vincennes Avenue, Chicago 20, Ill.



FIVE MAGAZINES THAT INFLUENCE GAS RANGE BUYERS

Ladies' Home Journal *American Home*
Better Homes & Gardens
McCall's *Woman's Home Companion*

These leading national magazines have a combined monthly readership of more than 21,500,000 women—families in the upper income brackets—housewives who want and can *afford* to buy deluxe gas ranges. Take advantage of the Harper Center Simmer Burner advertising in these magazines . . . *demonstrate* and *talk* the advantages of Harper top burners.



The Harper Center Simmer Burner operates on the unique principle of "2 burners in 1"...a STARTING BURNER for frying and to start foods boiling, plus a small, economical COOKING BURNER, to maintain the cooking ... both controlled by the same handle. It is subject to finer gradations of low heats—greater control and economy—than any other top burner made.

HARPER CENTER SIMMER BURNER

"...Holds the Lines for Gas"

HARPER CENTER SIMMER

Large Volume Water Heating

A series of Articles for the Engineer, the Architect, the Salesman and the Contractor.
They show how to select and install correct types of Water Heater Systems for specific purposes.

By
Malcolm B. Mackay
The Burkay Company

CHAPTER VI

Part 2

Determining Required Capacity and Selection of the Proper Type of Water Heating System

The selection of the proper type of water heating system and the determination of the capacity—both recovery and storage—which will be required to supply a specific hot water demand involves *both* a correct understanding of the characteristics of the peak hour hot water demand which must be satisfied *and application* of the proper type and capacity of a system to adequately supply such demand. Failure of the water heating system to provide hot water in adequate volume or inability to maintain the minimum hot water temperature is, in practically every instance, directly traceable to failure to properly evaluate the demand characteristics or lack of sufficient system capacity, or both.

(1) The various types of water heating systems, the advantages and/or limitations of each on the basis of performance and type of fuel or heating medium employed, and the applicability of each type of system to specific types of hot water demand is analyzed in detail in Chapter I.

(a) Choice of Fuel. Where two or more types of fuel are available, the choice of fuel to be employed may involve not only the determination of which type is best suited to the task but also the question of operating cost.

(b) The chart shown in Figure 11 provides a means for quickly and accurately computing the cost of heating a specific volume (1,000 gallons) of water under varying conditions of water temperature rise and at two levels of thermal and/or overall efficiency. By means of this chart it is possible to compute the comparative cost of heating a stated volume of water under identical conditions using two or more types of fuel where the *unit fuel cost* is known.

The *number of standard units* of each type of fuel required—at the two levels of efficiency shown for each in Columns "D" and "G"—to heat 1,000 gallons of water under varying conditions of water temperature rise are shown in columns "I" to "X," inclusive. To determine the fuel cost per thousand gallons of hot water, multiply the cost of the standard fuel unit by the factor appropriate to the number of degrees which the water must be raised in tempera-

Figure No. 12

Water Heater Capacity Conversion Table

-A- Where Actual Required Water Temperature Rise Is -	Percentage of Rated Water Temperature Rise which will be available when water must be raised the number of degrees shown in column "A"		
	WHEN RATED TEMPERATURE RISE IS -		
	60 Deg. F.	80 Deg. F.	100 Deg. F.
Degrees F.	-B-	-C-	-D-
150	40%	53%	67%
140	43	57	71
130	46	62	77
120	50	67	83
110	55	73	91
100	60	80	100
95	63	84	105
90	67	89	111
85	71	94	118
80	75	100	125
75	80	107	133
70	86	114	143
65	92	123	154
60	100	134	167
50	120	160	200
40	150	200	250

To determine the ACTUAL recovery (Water Heating) Capacity of a given Water Heater - In Gallons of Water Per Hour - When the Heater must Raise the Water Temperature MORE or LESS than it's Rated Capacity, MULTIPLY the Rated Capacity - in Gallons Per Hour - by the Figure appearing on the line showing the ACTUAL Number of Degrees which the Water will have to be RAISED in Temperature - appearing in Column "B", "C" or "D" - depending on whether the Rated Recovery Capacity of the Heater is based on RAISING the Water Temperature 60, 80 or 100 Degrees F.

Figure No. 11—Water Heating Fuel Requirements

To Determine the Cost of raising a stated volume of water a given number of degrees F at each of two indicated, over-all efficiencies, Multiply the Unit Fuel Cost by the figure appearing in the column listing the water temperature rise.

TYPE OF FUEL	STANDARD FUEL UNIT	AVERAGE HEAT CONTENT OF FUEL UNIT IN B.T.U's.	AT THERMAL EFFICIENCY OF HEATER OF-	AVAILABLE B.T.U's PER UNIT AT THERMAL EFFICIENCY INDICATED IN COLUMN "D"	AVAILABLE B.T.U's PER UNIT AFTER REFLECTING STAND-BY HEAT LOSS OF 25% (75% OF THERMAL EFFICIENCY)	EQUIVALENT TO OVER-ALL EFFICIENCY OF	FUEL UNITS REQUIRED TO PROVIDE 1,000,000 USABLE B.T.U's AT INDICATED OVER-ALL EFFICIENCY IN COLUMN "G"	1,000 GALLONS WATER TO 140° FROM 40° — 833,000 B.T.U's REQUIRED — 100 DEGREE RISE	1,000 GALLONS WATER TO 140° FROM 50° — 749,700 B.T.U's REQUIRED — 90 DEGREE RISE
-A-	-B-	-C-	-D-	-E-	-F-	-G-	-H-	-I-	-K-
NATURAL GAS	1 M.C.F.	1,050,000	80%	840,000	630,000	60 %	1.43	1.32	1.19
" "	1 M.C.F.	1,050,000	70%	736,000	552,000	52.5%	1.814	1.51	1.36
MAN'FRD GAS	1 M.C.F.	530,000	80%	424,000	318,000	60%	3.144	2.42	2.36
" "	1 M.C.F.	530,000	70%	371,000	278,250	52.5%	3.54	2.99	2.69
MIXED GAS	1 M.C.F.	850,000	80%	680,000	510,000	60%	1.96	1.63	1.47
" "	1 M.C.F.	850,000	70%	595,000	446,250	52.5%	2.24	1.87	1.68
PROPANE GAS	1 GALLON	91,500	80%	73,200	54,900	60%	18.21	15.17	13.7
" "	1 GALLON	91,500	70%	64,050	48,038	52.5%	20.82	17.34	15.6
BUTANE GAS	1 GALLON	102,600	80%	82,080	61,560	60%	16.24	13.53	12.18
" "	1 GALLON	102,600	70%	71,820	53,865	52.5%	18.56	15.46	13.91
FUEL OIL	1 GALLON	140,000	70%	98,000	73,500	52.5%	13.6	11.33	10.2
" "	1 GALLON	140,000	60%	84,000	63,000	45%	15.84	13.22	11.9
COAL	1 TON	25,000,000	60%	15,000,000	11,250,000	45%	.089	.074	.067
"	1 TON	25,000,000	50%	12,500,000	9,375,000	37.5%	.107	.088	.08
STEAM	1 M. LBS	1,000,000	90%	900,000	675,000	67.5%	1.48	1.23	1.11
"	1 M. LBS	1,000,000	80%	800,000	600,000	60 %	1.67	1.39	1.25
ELECTRICITY	1 K.W.H.	3,412	100%	3,412	2,559	75%	390.7	325.5	292.8
"	1 K.W.H.	3,412	90%	3,071	2,303	67.5%	434.2	361.7	325.5

ture as shown in Columns "I" to "X," inclusive. *For example:* To determine the cost of heating one thousand gallons of water from 60° to 140° F., with *Natural Gas* at $0.65 per thousand cubic feet, where the thermal efficiency of the heater is 80%, multiply the unit fuel cost 0.65 by the factor 1.06 shown in Column "L," first line. The resulting figure, .699, indicates that the cost will be $0.699. By comparison, the cost of electricity at $0.0075 per kilowatt hour would be .0075 times 260.4 or $1.953 if the heater operated at a thermal efficiency of 100%.

Characteristics of the hot water demands originating from various types of requirements or service—the *necessity* for interpreting hot water requirements on the basis of the *maximum* demand for hot water which will occur in a single hour, or the *peak hour hot water demand*—and directions for *determining* it, are given previously in detail.

Actual Water Heater Capacity

(1) Lack of sufficient capacity in a water heating system frequently results from failure to *convert* the rated recovery capacity of the heater—expressed in gallons of water *raised* a specified number of degrees, F., *per hour*—to the number of gallons which the heater will be able to heat when it is necessary to raise the water temperature a *greater* number of degrees. For example: A water heater having a rated recovery capacity of 100 gallons of hot water per hour at a 60° temperature rise would be capable of recovering *only* 60 gallons when called upon to *raise* the water temperature 100° F.

(2) It will accordingly be apparent that it will be necessary to determine the *maximum* number of degrees F., which the water must be raised under the most unfavorable condition and *convert* the rated recovery capacity of the heater—in *gallons per hour*—to the *actual* number of gallons which it will be able to heat per hour *before* determining the size of the heater which will be required.

(a) To determine the maximum water temperature rise which must be anticipated under the most unfavorable operating conditions, subtract the *lowest,* anticipated (Winter) cold water supply temperature from the *required* temperature of the hot water or that which is to be *maintained* in the storage tank. From the above it will be apparent that it will require a water heater having a *larger* hourly recovery capacity to supply a given number of gallons of 130° water in Chicago than in Miami,

and Comparative Fuel Cost Chart—Figure No. 11

The figures in the last 12 Columns ("I" to "X" inclusive) indicate the number of Fuel Units required to raise a Stated Volume of Water a designated number of degrees F at each of two indicated efficiencies.

1,000 GALLONS WATER TO 140° FROM 60°	1,000 GALLONS WATER TO 140° FROM 70°	1,000 GALLONS WATER TO 140° FROM 40°	1,000 GALLONS WATER TO 180° FROM 50°	1,000 GALLONS WATER TO 180° FROM 60°	1,000 GALLONS WATER TO 180° FROM 70°	1,000 GALLONS WATER TO 140° FROM 40° AND 40% FROM 140° TO 180°	1,000 GALLONS WATER TO 140° FROM 50° AND 40% FROM 140° TO 180°	1,000 GALLONS WATER TO 140° FROM 60° AND 40% FROM 140° TO 180°	1,000 GALLONS WATER TO 140° FROM 70° AND 40% FROM 140° TO 180°
666,400 B.T.U's REQUIRED	583,100 B.T.U's REQUIRED	1,166,000 B.T.U's REQUIRED	1,082,900 B.T.U's REQUIRED	999,000 B.T.U's REQUIRED	916,300 B.T.U's REQUIRED	966,280 B.T.U's REQUIRED	882,980 B.T.U's REQUIRED	799,680 B.T.U's REQUIRED	716,380 B.T.U's REQUIRED
80 DEGREE RISE	70 DEGREE RISE	140 DEGREE RISE	130 DEGREE RISE	120 DEGREE RISE	110 DEGREE RISE				
-L-	-M-	-N-	-P-	-Q-	-R-	-S-	-T-	-U-	-X-
1.06	.926	1.85	1.72	1.59	1.45	1.53	1.4	1.27	1.14
1.21	1.06	2.11	1.96	1.81	1.66	1.75	1.6	1.45	1.3
2.09	1.83	3.67	3.4	3.14	2.86	3.04	2.78	2.52	2.25
2.39	2.09	4.19	3.89	3.59	3.29	3.47	3.17	2.87	2.57
1.31	1.14	2.27	2.12	1.96	1.8	1.89	1.73	1.57	1.4
1.49	1.31	2.61	2.43	2.24	2.1	2.17	1.96	1.79	1.61
12.1	10.7	21.24	19.72	18.19	16.69	17.6	16.1	14.56	13.05
13.9	12.13	24.27	22.54	20.79	19.07	20.11	18.38	16.64	14.91
10.82	9.47	18.93	17.59	16.23	14.88	15.69	14.35	13.	11.63
12.37	10.82	21.65	20.1	18.54	17.01	17.94	16.39	14.84	13.3
9.07	7.93	15.86	14.73	13.69	12.46	13.14	12.	10.88	9.74
10.59	9.26	18.51	17.19	15.86	14.54	15.81	14.	12.69	11.37
.059	.052	.104	.096	.089	.081	.085	.078	.071	.064
.071	.062	.124	.115	.107	.096	.103	.094	.085	.076
.987	.864	1.73	1.6	1.48	1.36	1.43	1.31	1.18	1.06
1.11	.972	1.94	1.8	1.67	1.53	1.61	1.47	1.33	1.19
260.4	227.8	455.6	432.2	390.3	358.	377.6	345.	312.4	279.9
289.3	253.5	506.3	470.2	433.7	397.8	419.5	383.4	347.2	311.

Florida. In Chicago, where the cold water supply temperature drops to 40° F., or occasionally lower, it would be necessary for the heater to raise the water temperature 100°, while in Miami, where the temperature of the cold water seldom is lower than seventy degrees in winter, it would be necessary for the heater to raise the water temperature only 70° F., when supplying 140° F., water. The recovery capacity of a given water heater operating in Chicago in January would accordingly be only 70% of the capacity of the same heater operating in Miami, or, conversely, the recovery capacity of a heater operating in Miami would be approximately 43% *greater* than that of one operating in Chicago in winter.

(b) For convenience in converting the rated recovery capacity of a water heater—in gallons of water *raised* a specified number of degrees F. per hour—to the *actual* capacity which will be available when it is called upon to raise the water temperature a *greater or lesser* number of degrees, a conversion table for this purpose, Figure No. 12, is given herewith.

Relative Size of Hot Water Storage Tank

(1) When determining the size of the hot water storage tank to be employed in a water heating system it should first be understood that the function of the tank is to maintain a reserve supply of hot water which will enable the system to satisfy a demand that may *exceed* the recovery capacity of the heater during a period of one, or *more* hours or supply hot water at a rate of flow —measured in gallons per minute— that may *exceed* the rate at which the heater can supply hot water during *short* periods. Were it not for the fact that the rate of flow at which hot water is required during the course of a day may, in almost every instance, fluctuate widely and, on numerous occasions, be non-existant, it would be unnecessary to maintain a stored reserve of hot water. This would be particularly true where— in industrial processing for example —hot water might be required at a comparatively low but *uniform* rate of flow during more or less frequent intervals. Under such circumstances a standard type of instantaneous water heater, which would heat the water only as required, would be most suitable providing the rate of flow at which the hot water would be required *did not* exceed the rate of flow which the largest available heater would be able to supply at the existing water temperature rise.

(2) Having established the func-

tion of the hot water storage tank, attention is also called to the fact that a definite but variable relationship exists between the recovery capacity of the heater and the capacity of the storage tank, and, particularly, between the size of the tank and the peak hour and/or the peak period hot water demand if such peak period exists for *one or more* consecutive hours as formerly described.

(a) Installation of a hot water storage tank having a capacity—in gallons—equal to several times the actual recovery capacity of the heater is, admittedly, contrary to the obsolete theory that the use of a hot water storage tank relatively large in proportion to the recovery capacity of the heater is uneconomic. This theory was apparently predicated upon the supposition that the standby, or heat loss from a large tank—due to radiation—would appreciably decrease the over-all efficiency of the system or materially increase the cost per thousand gallons of hot water. Such reasoning is, however, incomplete and therefore inconclusive. On the contrary, there is ample evidence that, where the tank is well *insulated,* the slightly increased operating cost which may result from the heat loss factor incidental to the employment of a relatively large tank is so trifling, in proportion to the over-all cost of operation as to be insignificant. It must also be remembered in this connection that, as the capacity of the tank *increases* due to increase in diameter, the area of the outer surface of the tank *decreases* with respect to its capacity and that, as a result, the rate of heat loss by radiation *decreases* as the tank size is increased.

Since the increase in operating cost which may be attributed to the increased heat loss by radiation resulting from the employment of a relatively large hot water storage tank is so trivial in proportion to the over-all cost of operation as to be insignificant, it will be manifestly apparent that the increased initial cost of installing a larger water heating unit having a greater recovery capacity and a smaller storage tank *would not* be offset or absorbed by any possible savings in operating cost during the normal life of the system. It must be recognized, however, that the installation of a tank having a relatively large capacity in proportion to the recovery capacity of the water heater would be justified *only* where the hot water demand attains an unusually high peak during a *single hour,* and *does not recur* during the two or three hours immediately following an hour of peak demand in which the heater could again recover or heat the entire tank of water.

(b) Improper installation of the water heating unit and the hot water storage tank—particularly with respect to the inter-connecting piping—may not only seriously hamper, but often *defeat* the proper functioning of the tank as a stabilizer to maintain a uniform temperature in the stored hot water and/or in the hot water delivered to the fixtures. This subject will be covered in detail in a following chapter.

New Officers of Indoor Climate Institute

Third Annual Meeting of the Indoor Climate Institute, non-profit, impartial service organization of the heating industry, was held in Detroit, September 12, 1946. The following Officers and Directors were elected for the ensuing year: President, T. A. Crawford, General Manager, Timken Silent Automatic Division, The Timken-Detroit Axle Company, Detroit, Michigan; Vice President, J. M. McClintock, Manager, Freeman Stoker Division, Illinois Iron & Bolt Company, Chicago, Illinois; Secretary, R. E. Moore, Vice President, Bell & Gossett Company, Morton Grove, Illinois; Treasurer, E. N. McDonnell, President, McDonnell & Miller, Inc., Chicago, Illinois.

In addition to the Officers elected, who are also Directors, the following Directors were elected: A. T. Atwill, President, Quaker Manufacturing Company, Chicago, Illinois; Allen Butler, Vice President, Perfex Corporation, Milwaukee, Wisconsin; Bruce T. Cunningham, Research Products Corporation, Madison, Wisconsin; J. J. Donovan, Assistant General Sales Manager, Chrysler Corporation, Airtemp Division; L. N. Hunter, Vice President in charge of Research, The National Radiator Company, Johnstown, Pennsylvania; C. D. Lyford, Vice President—Gas Controls Division, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.; W. A. Matheson, Vice President, Williams Oil-O-Matic Heating Division, Eureka Williams Corporation, Bloomington, Ill.; Joseph R. Murphy, Vice President, Taco Heaters, Inc., New York City; C. A. Olsen, President, The C. A. Olsen Manufacturing Company, Elyria, Ohio; Jack Searls, Sales Manager, White-Rodgers Electric Company, St. Louis, Mo.

There were no changes in staff personnel for the ensuing year. Walter P. Davis, Buffalo, New York, remains as Managing Director and Mrs. Gertrude B. Finnegan, Detroit, Michigan, as Secretary of the Institute.

Plans for national advertising and final distribution of the new booklet, "Look Under the Hood," telling the most impartial story ever written about domestic heating, were approved.

ECONOMY and THRIFT In this Packaged Unit!

—MacTavish Says

Coroaire PATENTED The Scotch Heater

The Outstanding Feature is in the heart of COROAIRE,—the exclusive Venturi tube heat exchanger, made of cast iron.

This new development provides greater heat distribution and thus increases heating capacity and efficiency.

That's why COROAIRE can heat the conventional 5 or 6 room home on one floor without extreme temperature differentials.

It is also ideal for stores, offices and all kinds of small business places. COROAIRE is a live load builder that sells on sight and reputation—

and a heating miracle in a complete package!

5 exclusive profit-builders

1. **Only COROAIRE has the exclusive cast iron patented Venturi tube heat exchanger.**
2. **Only COROAIRE has a 5 sq. inch to 1 sq. inch wiping surface in the exterior of Venturi exchanger and a 28 foot flue travel . . . *compared* to a 6 to 8 foot flue travel on other conventional types of heat exchangers.**
3. **Only COROAIRE has this patented restricted inside flue travel that holds gases, *utilizes* heat that might otherwise escape.**
4. **Only COROAIRE has the patented adjustable revolving grill.**
5. **Only COROAIRE provides *outstanding* economy of operation . . . actual tests prove this beyond any question.**

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A.G.A. Convention
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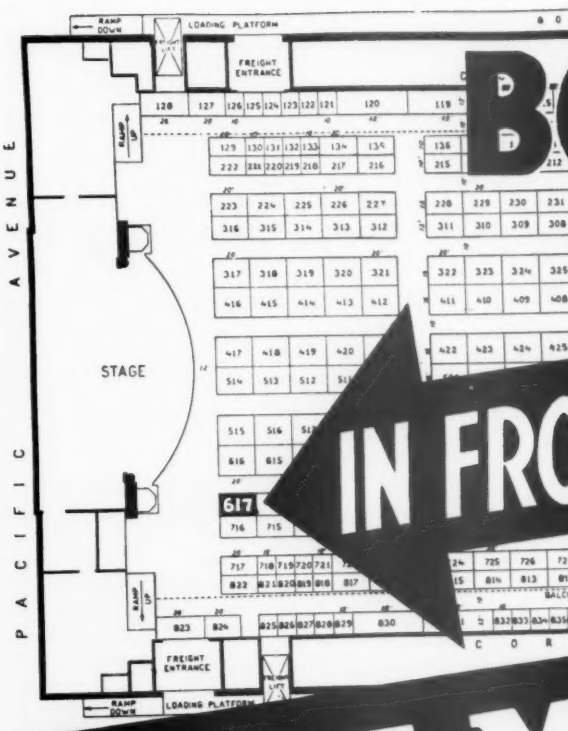

An Invitation

to visit our Booth No. 617 at the A. G. A. Convention.

We would like to renew contacts with many old friends and meet new ones. We will have photographs and other data on hand which will prove of interest to you.

Naturally, if you have some problem on your mind concerning Gas Holders, Purifiers, or High Pressure Tanks, we shall be glad to talk them over with you — no obligation.

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RECENT COURT DECISIONS *Affecting Gas Utilities*

Avoid Legal Pitfalls

By
Leo T. Parker
Attorney at Law
Cincinnati, Ohio

A FEW DAYS AGO a reader wrote a letter: "I have read your legal articles with great interest for over 15 years. Please briefly list for me what you *know* to be law suit pitfalls to be avoided by gas company officials."

I am glad indeed that this reader made the suggestion. I shall briefly review certain leading higher court decisions which, in my opinion, illustrate legal pitfalls.

Contract Pitfalls

First, we shall review interesting higher court decisions involving contract law of which gas company officials and employes should have knowledge.

Contrary to the opinion of many readers all contracts are void which stipulate a "penalty" to be paid by a contracting party who breaches the contract. In other words, the higher courts hold that the measure of damages recoverable against a person or company, for failure to fulfill the terms of a contract, is the *actual loss* sustained by the other party.

For illustration, in Home v. Robinson, 40 Pac. (2d) 637, it was shown that a consumer contracted with a gas company to purchase a specified quantity of gas. The contract contained a clause by which the consumer guaranteed that if he failed to fulfill the terms of the contract he would pay the gas company a large sum as "liquidated" damages.

The consumer breached the contract, and the gas company filed suit to collect the specified liquidated damages. Although the lower court held the consumer liable the higher court reversed the verdict, saying:

"A provision of a contract, which undertakes to fix a penalty as liquidated damages for the breach of a contract . . . is void, if the actual damages which may be suffered by the seller through the breach of the contract are susceptible of proof."

Another important point of contract law is: Under no circumstances may a gas company be relieved from damages caused by negligence of its employes. Therefore, a contract with such a stipulation is void. This rule of law is applicable to all controversies, including gas explosion suits, injuries to employes, or damage to persons and property, and the like.

Verbal Contracts

It is important to know that all contracts are void which cannot be performed within one year. Thus, in a late higher court case, Ford, 132 S. W. (2d) 46, it was held that a seller could not recover damages on a verbal contract dated in 1938 and which extended over a period of three years. But in another late and leading case, 148 Fed. (2d) 121, reported July, 1945, it was held that if a buyer and seller *correspond* regarding a verbal contract, and arrange details, the verbal contract assumes the importance and legal status of a written contract.

Also, in Hopper, 146 Fed. (2d) 364, reported 1945, the higher court held that a verbal contract is valid although it specifies a period more than one year, *providing* either party has the privilege of cancelling the contract within one year. This court said:

"If the contract, by its terms, is not to be performed within a year, it is void; but if it may, 'by its terms,' be performed within a year, it is not, even though it may not be performed, or not likely to be performed, within that time. . . ."

Of course, it is well known that perpetual franchises are void. On the other hand, a gas company cannot prevent a municipality from establishing its own gas system, if the gas company has *no* exclusive franchise. See Westchester Joint v. Village of Pelham, 265 N. Y. S. 491, where municipal officials decided to construct a gas system and install mains in competition to a gas corporation. Since the municipality had not in the past granted an exclusive franchise to the gas company, the court held that the city could *not*, by any legal procedure, be prevented from installing its own system, and said:

"The plaintiff (company) does not possess an exclusive franchise."

Franchise Not Implied

Considerable discussion has arisen from time to time over the legal question: Does the ordinary franchise imply that the grantor as a municipality will *never* do any act by which the value of the franchise grant may in the future be reduced? The answer is no because such an implication would be altogether too far-reaching. Moreover, the powers of a municipality, even in matters not immediately connected with franchises, are not usually left to implication.

For illustration, in Skan, 184 U. S. 354, the legal question was presented the Supreme Court of the United States whether without an exclusive contract, and after expiration of the franchise, a municipality is impliedly obligated to purchase a gas system previously used by the holder of a franchise.

It is important to know that in this case the Supreme Court held that although the act of the municipal officials to install its own system "may have seriously impaired the value of" the utilities property, the municipality had "taken none of it," and, therefore, it was not obligated to pay the utility any money or otherwise be interested in how the company should salvage its investment.

On the other hand, see the leading case of Joplin v. Southwest Missouri Company, 191 U. S. 150. In this case it was shown that a city ordinance was passed which granted a gas corporation the right to erect and operate a gas plant, necessary ac-

cessories, and to supply the inhabitants with gas for "a period of years."

The higher court construed this franchise to be *exclusive* for a *reasonable* period of time "sufficient in duration" to justify and net the gas corporation a profit which made the investment.

Implied Contracts

An implied contract may be equally as effective as an expressed contract, but such contracts should be avoided by gas corporations.

For illustration, in Board v. Southwest National Gas Company, 138 Pac. (2d) 525, a gas corporation sued a county to recover payment for gas which had been furnished to a public building during the past four years.

The county officials denied that it had contracted for the gas furnished the building, but the counsel for the gas company argued that the county must pay for the gas it used on the basis of an implied contract.

In refusing to hold the gas company entitled to recover payment for the gas, the higher court said:

"Under the record here submitted it definitely appears that the defendant (county) never assigned any obligation to pay for any portion of the gas which plaintiff or its predecessor was supplying to the municipal building."

Also, all surety contracts are void, unless in writing.

So, therefore, when a person *verbally* guarantees the debt of another for gas, it was just the same, from a legal standpoint, that no guarantees of payment was made. In other words, the gas company cannot hold the surety liable because the guarantee of payment was not in writing.

Written Contracts

Irrespective of verbal agreements the general law provides that both parties to a written contract must rely solely upon the *written* agreement. In other words, the courts will not consider testimony as to verbal agreements which tend to contradict a written contract, the verbal statements prove fraud.

For example, assume that *after* a written contract is made one contracting party makes a *verbal* promise to the other. It matters not what the promise may be, the promisor is *not* liable on the promise because *no* consideration is present. And if one contracting party makes the *same* verbal promise *before* the contract is made, he is not responsible for such promise because the court ordinarily will not listen to testimony of verbal agreements which vary or contradict a written contract.

Bankrupts Promise

An important point of law is that a person who has taken benefit of bankrupt laws may be held accountable for a written promise that he will pay a debt although discharged in bankruptcy. The same law is applicable to "outlawed" debts.

Modern higher courts consistently hold that an old debt or gas bill, which is outlawed by statutes of limitations, may be renewed (1) if the debtor is induced to pay any small part of the old debt; (2) or if he pays interest on the old debt; (3) or if he makes a new promise to pay the old debt. This rule applies only to debts which are "outlawed" by state statutes. Also, it is well established that a debtor may assume a *new obligation* to pay an old debt, from which he is legally *discharged in bankruptcy* proceedings. However, such promise to pay must be a *positive* new obligation, otherwise the bankrupt is not bound to pay.

For illustration, in Armstrong v. Neblett, 19 S. W. (2d) 362, it was

If You Have to—
BUST Concrete
DIG Clay or Shale
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Will Do It Quickly and Easily

"Pecking" away at concrete with a sledge—cutting out asphalt—trying to cut thru shale, or spade clay, or dig frozen ground in winter—are back-breaking, time-consuming jobs for your crews—and costly to you.

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Then too, SYNTRONs are completely Self-Contained. No compressor to tow around—no hose to snarl and kink—no battery box or cable to handle—just the hammer itself.

Investigate the advantages of this tool—write to

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920 Lexington Ave., Homer City, Pa.

disclosed that a debtor who had been discharged in bankruptcy wrote to a creditor saying that he would pay "a part of the money I owe you this fall. I cannot yet say how much, but you are on the list to be paid first."

When the debtor failed to pay the account, the creditor filed suit contending that the above quoted letter renewed the obligation discharged in bankruptcy. However, the court held this letter did *not* renew the old debt, because it was not a positive promise to pay the old debt.

On the other hand, no person has a *valid* discharge in bankruptcy, if he used fraud, deceit or false pretense when obtaining credit. And, also, it has been held that a motor vehicle driver who recklessly kills a pedestrian, or other person, cannot avoid paying a damage award by taking benefit of the bankruptcy laws.

Signed Release

Generally speaking, a statement or release signed by an injured employe will not relieve the gas company from damage or compensation payments.

For instance, in Public Utilities Corporation v. Garden, 32 S. W. (2d) 1058, a gas company employe was injured while digging a ditch in which a gas line pipe was to be laid.

In a later suit the gas company introduced a statement signed by the employe which purported to detail the circumstances of his injury, and it was therein stated as a fact that the gas company was not to be held liable for the injury. The injured employe admitted signing the statement, but testified that he did not read it when he signed the same.

The lower court held the gas company not liable, but the higher court reversed this verdict, saying:

". . . Appellee's (employe's)testimony as to the circumstances under which it was signed was such, if believed, as to discredit the statement altogether and cause it to be disregarded by the jury."

Obviously the obligation of a gas company to provide reasonably safe places for employes to work cannot be avoided by any contract, or other means.

For instance, in Fisher v. Laclede Gas Company, 31 S. W. (2d) 770, a gas company plant was being repaired. Tools and materials were scattered over a floor, and in picking his way through them an employe slipped, stumbled, and fell through the opening to the floor below, and was seriously injured. He sued the gas company for damages.

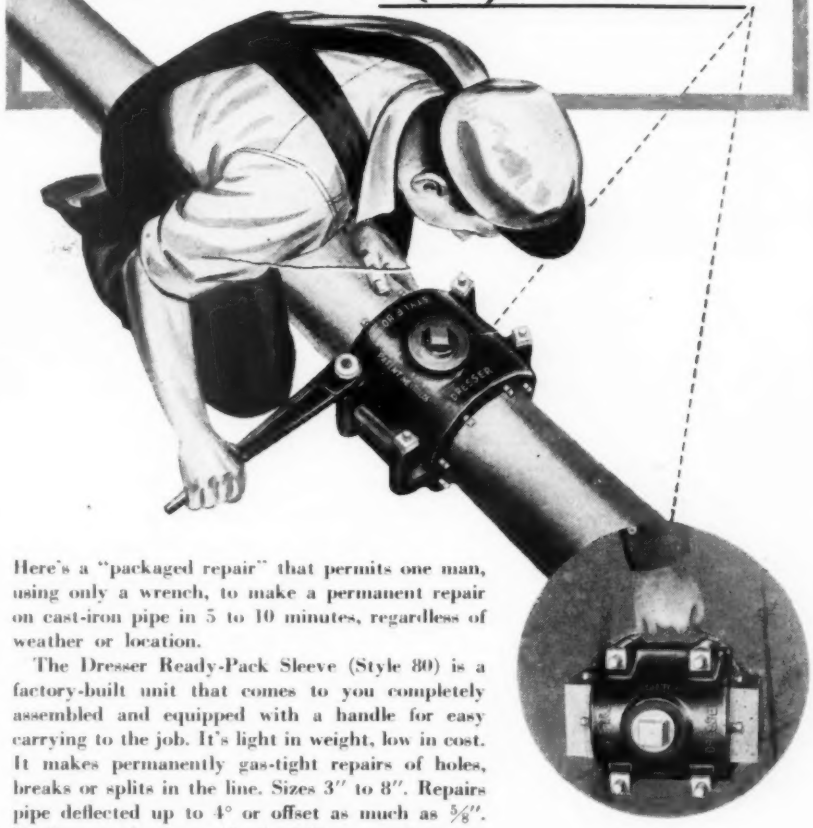
In holding the injured employe entitled to recover $10,000 damages, the court said that it is a legal duty of all employers to provide employes with reasonably safe working places.

Also, see Federal Company v. Ragle, 25 S. W. (2d) 898, where it was disclosed that a gas company employe, who had just quit work for the day, was injured when attempting to crank his own automobile which he used to transport himself to and from his work. In holding the injured employe entitled to recover damages the court said that the gas company furnished a parking place for the automobile and while the employer had not assumed the obligation of transporting the employe to and from work, yet it knew of the arrangement.

Advertising Counsel

Donahue & Coe, Inc. have been appointed Advertising Counsel by the Gas Appliance Manufacturers Association. Extensive plans to promote "CP" automatic gas ranges during the coming year are now being prepared.

A permanent pipe repair in 10 minutes with this handy *Ready-Pack Sleeve*



Here's a "packaged repair" that permits one man, using only a wrench, to make a permanent repair on cast-iron pipe in 5 to 10 minutes, regardless of weather or location.

The Dresser Ready-Pack Sleeve (Style 80) is a factory-built unit that comes to you completely assembled and equipped with a handle for easy carrying to the job. It's light in weight, low in cost. It makes permanently gas-tight repairs of holes, breaks or splits in the line. Sizes 3" to 8". Repairs pipe deflected up to 4° or offset as much as 5/8". Resilient gaskets provide flexibility, guard against recurrence of break. Write for information.

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DOES PULSATION PLAY TRICKS IN YOUR PLANT?
*The Measurement of Pulsating Flow.
An orifice meter, or any other type differential meter, cannot be used to measure a pulsating flow accurately ...This fact has been known about as long as the differential type meter has been used...At the present time, very little is known of corrective measures, due largely to the complexity of the problem.

*CORRECTION ... PLEASE!

It's true that very little was known about correcting pulsating flow prior to the introduction of the FLUOR Pulsation Dampener, about a year ago. Since that date, FLUOR Pulsation Dampeners have been installed under widely varied conditions. In each instance, they have solved the particular problem encountered.

The FLUOR Pulsation Dampener converts pulsative flow into a smooth, steady stream. The undesirable ... and costly ... effects of pulsating flow are stopped before they can get started. The *cause* is removed, so the *effect* is eliminated, too.

To instrument makers and users, this means a much wider range of application for all types of differential meters ... and more accurate measurement by every meter installed ... wherever a FLUOR Pulsation Dampener is used. If you want to know more about this proved way to keep your meters honest—and to eliminate many other effects caused by pulsative flow in gas, air and vapor lines—write for the new FLUOR Bulletin PD-1.

*Statement from a recently published Engineering Handbook

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P.C.G.A. Holds Fifty-Second Annual Meeting

THE Pacific Coast Gas Association held its 52nd Annual Meeting, Sept. 10th, 11th and 12th, in San Francisco, Calif. Total attendance was 747.

In addition to the General Sessions, held Tuesday afternoon, Wednesday forenoon and afternoon Thursday forenoon, there were meetings of the Manufacturers Section, Accounting Section, Sales and Advertising Section and the Technical Section.

In opening the first General Session Tuesday, President H. W. Edmund said in part:

"We are now in process of recovering from the most stupendous war of all time. Business is disrupted: there is dissension between groups of our citizens which offers a real threat to the way of life which has made our country and our industry great. I think it would please those illustrious men who have gone before us and would be in the splendid tradition of this association if we who are here dedicate ourselves to the solution of the present problems of our country and our industry with a respectful and grateful salute to our predecessors and their accomplishments. Let us turn our eyes forward for it is our job to live the present and build the future. The program of this meeting is a review of the present and a short glimpse into our hopes for the future. * * *

"Let me be more specific on some of the jobs we have to do. Not long ago, Mr. Herman Russell, president of the Rochester Gas and Electric Corporation, found it necessary to chide the industry for its failure to grasp the importance to it of kitchen ventilation. There are many tough problems in connection with kitchen ventilation — mechanical problems, ordinance problems, selling problems. Nevertheless, kitchen ventilation offers a solution to the talking point used by our competitors that gas is hot and dirty, and, at the same time, affords a real improvement in the home kitchen. We must get behind kitchen ventilation and our manufacturers must be alive to the necessity of making needed improvements in gas ranges. * * * *

"In spite of the large sums being spent in our industry for research, promotion, and advertising, we are still far behind competing industries. The coal industry research program far exceeds ours, and the advertising and promotion of electrical industry is greater in both volume and, I think, in effectiveness. Granted that we have less money, this makes it all the more necessary that we direct most of our shot at the more important objectives and make a little go a long way by trying to so prepare our national cooperative copy that individual companies everywhere can tie in with it. Our Pacific Coast Association Cooperative Advertising Committee has been somewhat astonished to find out recently that it would be far more costly for it to reproduce national cooperative advertisements in Pacific Coast media than to write its own.

"These and all other difficulties can be satisfactorily solved. Let us keep in mind that the fundamental facts of economics and science support the continued expansion of the use of gas fuel. Raids by other industries, government subsidy competitors, and ofttimes our own lack of foresight and unity create problems which are part of the challenge which we accept. Their solution offers great reward.

"In the last analysis, work done now is done in preparation for the future. Our personal future and the future of the gas industry depends

Photo Gladser
LeRoy M. Edwards, President

Western Photo Service
A. H. Sutton, Vice President

D. G. Martin, Treasurer
General Auditor, Pacific Gas & Electric Co.

upon what we are doing and thinking now. The competitive period which faces us is a challenge to our wits and courage. It is a time for boldness, initiative, and enterprise. If we all accept this challenge and go to work, our future is assured. Our industry has never been as well organized as it is today. It is a growing and dynamic industry; let us keep it so."

Officers elected for the coming year were as follows:

President—LeRoy M. Edwards, Vice President-General Manager, Pacific Lighting Corporation;

Vice-President—A. H. Sutton, President, Mission Appliance Corporation;

Treasurer—D. G. Martin, General Auditor, Pacific Gas and Electric Company.

Officers of the Manufacturers Section were:

General Chairman—Henry Honer, Western Stove Company;

General Vice Chairman—C. A. Gabriel, Monarch Heating Company;

Accessories Division

Chairman—M. M. Kennedy, Domestic Thermostat Company;

Vice Chairman—J. F. Ray, General Controls Company;

Heating Division

Chairman—L. M. Hull, Hammel Radiator Engineering Company;

Clifford Johnstone
Managing Director
Pacific Coast Gas Assn.

Vice Chairman—J. P. Tuck, International Sales Company;

Range Division

Chairman—R. S. Atchison, O'Keefe & Merritt Company;

Vice Chairman—W. M. Couzens, Gaffers and Sattler;

Water Heater Division

Chairman—R. H. Hinckley, General Water Heater Corporation;

Vice Chairman—A. F. Rice, Rheem Manufacturing Company.

Report of Awards Committee

The Awards Committee presented its reports as follows:

A Committee Award to the Committee on Water Heater Sizing, Clyde H. Potter, Southern Counties Gas Company, Chairman, Claude Ballinger, Republic Heater Corporation, Co-Chairman, for the conception, production and presentation of the Gas Water Heater Sizing Program.

Honorable Mention to K. L. Boosey, Pacific Gas and Electric Company, for his paper, "Better Relations with Personalized Collection Practices." This award is made with the recommendation that next year's Award Committee review its value to the industry after further practical application, for possible recommendation for a higher award.

Honorable Mention to Arthur F. Bridge, Southern Counties Gas Company, for his paper, "The Texas Pipe Line."

It is apparent that all sections of the Association made valuable contributions to the industry during the past year, thanks to the support of management. The Committee, after careful consideration, recommends the award of the Basford Trophy be made to the Accounting Section, J. W. Vanier, Southern California Gas Company, Chairman.

Steel Shortage Hampers Gas Appliance Manufacturers in the Pacific Area

The shortage of steel sheeting represents the bottleneck which is retarding gas appliance manufacturing and will probably prevent appliance plants from running at more than 60 per cent the capacity required to supply 1947 needs, D. P. O'Keefe, Los Angeles, president, Gas Appliance Manufacturers Association, declared on September 1.

In an interview with a representative of AMERICAN GAS JOURNAL in his offices in the O'Keefe & Merritt Co., building, Los Angeles gas range manufacturers, which firm he heads as president, Mr. O'Keefe declared that steel, of which he said there simply is not enough at present to go around, is the principal bottleneck which is holding back full-scale production in the gas appliance industry.

The reconversion problem, Mr. O'Keefe pointed out, was completed months ago and the average appliance factory could step up its production at least 50 per cent within a matter of hours if sufficient steel could be obtained.

The steel shortage, the national president added, is particularly aggravated on the Pacific Coast where the lack of sufficient rolling mills to supply the area's needs in sheet steel invests appliance production there with problems somewhat different than in the east and middle west.

The situation with respect to aluminum, Mr. O'Keefe asserted, is not as critical as in the sheet steel field. The aluminum capacity, particularly in the West, he explained, was built up during the war and the result is that Los Angeles and other Western manufacturers have large stocks of aluminum at their disposal at this time.

The shortage of sheet steel and the availability of aluminum stock, Mr. O'Keefe said, has led some water heater manufacturers to use aluminum jackets for their heaters.

Cast-iron, the national president pointed out, is purely a local problem in the various areas of the country. It has, he stated, created bottlenecks in some sections of the country, but not on the West Coast. The problem with respect to castings in Southern California is local because cast-iron castings are supplied by local foundries, while steel sheets must be obtained from eastern steel mills.

Gas operated clothes drying appliances and summer and winter gas air conditioning units were cited by Mr. O'Keefe as fields in which the gas appliance industry will probably make considerable progress during the next year.

Industrial Instrumentation: Catalog No. 370 of The Foxboro Company, Foxboro, Mass., describes and illustrates indicating, recording and controlling instruments for pressure, temperature, flow, liquid level and humidity as well as other process variables.

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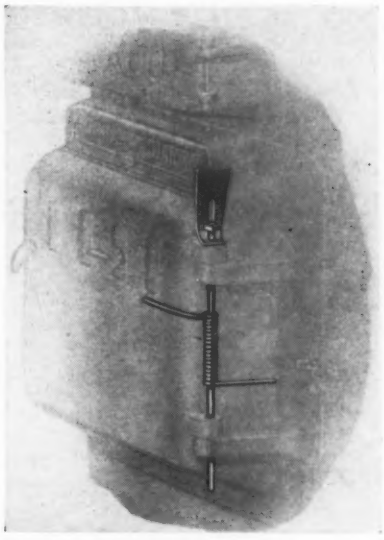
DESIGNED for CONVERSION BURNERS

OVER 50,000 IN USE



This device, designed for conversion burners, automatically closes the fire door of a boiler or furnace when blown open.

It consists of a cadmium plated door hinge pin, spring and wedge. The hinge pin replaces the regular fire door pins, the spring furnishes the motive power and the slotted wedge holds the fire door in the open position when required.

Furnished in 3/16 — 1/4 — 5/16 — 3/8" Sizes

INLAND MANUFACTURING CO.

1120 N. Cicero Avenue, Chicago, Ill.

GAS METERS

RADAR

Lambert Meter Co.

Plainfield, N. J.

CHORE BOY*

FACTORY ASSEMBLED AND TESTED

-READY TO SET IN THE FURNACE WHEN YOU LIFT IT OUT OF THE BOX

CHORE BOY GAS BURNER

A QUALITY UNIT THAT FITS PRACTICALLY ALL HOT AIR FURNACES AND BOILERS OF ALL SIZES . . .

These are features that make CHORE BOY easier to sell and easier to install; 1. Flame scrubs wall for maximum heat but will not cause warping; 2. Full automatic control for full efficiency and safety; 3. All controls concealed and protected; 4. One burner head with pilot in direct contact for instant ignition; 5. No small jets to carbon up; 6. Collapsible shield furnished to replace ash pit door; 7. Completely assembled—just slide through door and connect gas and electricity.

AMERICAN GAS ASS'N CERTIFIED

SEVERAL GOOD TERRITORIES STILL AVAILABLE

Write today!

* COMBUSTION ENGINEERS SINCE 1914

STANDARD FUEL ENGINEERING COMPANY

667 POST AVENUE S. • DETROIT 17, MICH.

Cooking Range Survey in Phila., Pa.

COOKING RANGES

Questions Asked:

Is your cooking range owned by:—

☐ Your family? ☐ Your landlord?

What type? ☐ Gas ☐ Electric ☐ Coal, Coke, Wood

If you had to replace your range, what kind would you buy?

☐ Gas ☐ Electric ☐ Coal, Coke, Wood

Division of Families Using Cooking Ranges As To Who Owns Their Range—By Rental Groups

(Reported by renters and owners)

Rental Group	Themselves		Landlord	
	Per Cent	Families	Per Cent	Families
Over $50.00	89.3%	108,681	10.7%	13,038
$40.00 to $49.99	85.0	80,217	15.0	14,132
$30.00 to $39.99	78.8	110,672	21.2	29,857
Under $30.00	79.5	119,430	20.5	30,754
Total	82.7	419,000	17.3	87,781

Division of Families As To Type of Cooking Range Owned—By Rental Groups

(Reported by renters and owners)

Rental Group	Gas		Electric		Coal, Coke, Wood	
	Per Cent	Families	Per Cent	Families	Per Cent	Families
Over $50.00	87.5%	106,392	11.7%	14,232	.8%	995
$40.00 to $49.99	92.7	87,482	7.1	6,668	.2	199
$30.00 to $39.99	90.4	127,193	8.8	12,341	.8	1,095
Under $30.00	89.3	134,061	6.9	10,351	3.8	5,772
Total	89.8	455,128	8.6	43,592	1.6	8,061

Division of Families As To Type of Range They Would Buy To Replace Their Present One—By Rental Groups

(Reported by renters and owners)

Rental Group	Gas		Electric		Coal, Coke, Wood	
	Per Cent	Families	Per Cent	Families	Per Cent	Families
Over $50.00	67.8%	82,609	31.5%	38,312	.7%	798
$40.00 to $49.99	70.0	66,064	29.6	27,885	.4	400
$30.00 to 39.99	71.8	100,836	27.6	38,791	.6	902
Under $30.00	74.4	111,767	25.0	37,521	.6	896
Total	71.3	361,276	28.1	142,509	.6	2,996

Compiled and Published by THE EVENING BULLETIN

A Consumer Analysis

The Evening Bulletin, Philadelphia, Pa., recently issued the "1946 Consumer Analysis of the Philadelphia Market." It includes a study of buying habits, ownership of appliances and dealer distribution.

The method chosen as the most dependable for the Philadelphia Market was that in which a questionnaire was personally delivered to the home, and picked up at a later date, at which time a shopping bag of merchandise was delivered to the housewife for the thought and trouble required to fill out the questionnaire.

The questions were answered by the housewife and by the husband or man of the house, assuring a complete family picture.

Replies to all basic questions in the consumer Analysis were tabulated by "Users" and "Non-Users," and then by "Rental Groups." This was determined by the expressed rental value given by renters and owners.

Of interest to the gas industry is the tabulation on cooking ranges. The complete tabulation is reproduced here. It shows the percentage of families now using a gas range who would buy an electric range if they were replacing their present gas range.

If this percentage is about the average throughout the country, it indicates the gas utilities have a real replacement selling job to do. The approximate age of gas ranges in service in the various communities is known. Where a gas range has been in service say 10 years, the owner should be informed fully on the superiority of the present up-to-date gas range, and kept advised at regular intervals. If this is done the percentage who would change from gas cooking would be reduced more than one-half.

We'll see you—
at Atlantic City, Booth 618
with a completely new remodeled line of
Pressure Regulators
The Chaplin-Fulton Mfg. Co.
38 Penn Avenue Pittsburgh 22, Pa.

Short Course in Gas Technology at Kingsville, Texas

FOR the Short Course in Gas Technology sponsored by the Southern Gas Association at the Texas College of Arts and Industries at Kingsville, Texas, August 27-29, approximately 200 were in attendance.

At the first General Assembly, Dean A. Strickland, President of the Southern Gas Association, presided and at the second General Assembly Frank S. Kelly, Jr., Immediate Past President of the Association presided.

The course was most successful and considerable interest was generated in the field of food and agricultural products dehydration with gas. The largest attendance was recorded in the Transmission Section. The National Association of Corrosion Engineers assisted in handling the subject of corrosion control in the Gas Transmission Section.

Following the welcoming speech by Dean A. Strickland, the aims of Short Course were set forth by Chester L. May, Vice-President, Lone Star Gas Co. and Chairman of the Advisory Committee.

The following papers were presented:

The Field of Gas in Air Conditioning, Dr. W. R. Hainsworth, Vice-President, Servel, Inc., New York, N. Y.

Gasoline from Natural Gas, P. C. Keith, President, Hydrocarbon Research, Inc., New York, N. Y.

Accomplishments of Short Course, Frank S. Kelly, Jr., President, Arkansas-Louisiana Gas Co., Shreveport, La.

Outstanding Developments in Gas Technology, Captain E. S. Pettyjohn, U.S.N.R., Director, Institute of Gas Technology, Chicago, Ill.

Developments in the Centrifugal Gas Compressor Field, H. M. Shedd, Petroleum Specialist, Carrier Corporation, Dallas.

Dehydration, Gilbert C. Wilson, Gilbert C. Wilson Laboratories, Pittsburgh, Texas.

Section on Air-Conditioning

Introduction to Principles of Air Conditioning, Dale S. Cooper, Dale S. Cooper and Associates, Consulting Engineer, Houston.

The Servel Method of Computation in Air Conditioning, H. Charles Pierce, Assistant Manager, Air Conditioning Division, Servel, Inc., Evansville, Indiana.

Simplified Load Estimate Calculations for Residential Summer Air Conditioning, C. A. McKinney, Engineer, United Gas Corporation, Houston.

Air Distribution Design, George Elmer May, Principal Utilization Engineer, New Orleans Public Service, Inc., New Orleans.

Design and Operation of Gas Air Conditioning Equipment

The Design and Application of Gas-Fired Air Dryers in Air Conditioning Work, H. W. Heisterkamp, Manager Dehumidifier Division, Bryant Heater Company, Cleveland.

Design, Research and Development of New Kathabar Residential Air Conditioner, J. K. Hawk, Kathabar Division, Surface Combustion Corporation, Toledo.

The Principles of Operation of the Air-O-Matic Air Conditioner, G. F. Zellhoefer, Eureka-Williams Corporation, Williams Division, Bloomington, Ill.

Research and Development in the Servel Gas-Fired Air Conditioner, Dr. E. N. Berry, Director of Research, Servel, Inc.

Natural Gas Transmission

Chairman—Mr. Elton Sterrett, National Association of Corrosion Engineers, Houston

Dehydration of Natural Gas, Jack Gordon, Mid-West Representative The Girdler Corporation, Louisville, Kentucky

Cathodic Protection, C. H. McRaven, Corrosion Engineer, Texas Pipe Line Company, Houston

Sacrificial Anodes, T. B. McDonald, Corrosion Engineer, United Gas Pipe Line Co., Shreveport, La.

Soil Surveys, M. E. Parker, Jr., Corrosion Engineer, Pan-American Pipe Line Co., Houston

Instrumentation — Lecture with Laboratory Demonstrations, Homer Givens, Engineer, La Gloria Corporation, Falfurrias, Texas

Dehydration of Foods and Other Products

Chairman—Dr. W. G. Hugly, Southwestern Settlement and Development Corporation, Houston

Uses for Old and New Crops, Gilbert C. Wilson, Gilbert C. Wilson Laboratories, Pittsburg, Texas

Dehydration of Farm Products and the Natural Gas Industry, E. C. Whipple, Agricultural Agents, Santa Fe Railroad, Galveston

Dehydration of Hay Using Natural Gas, George C. Lockhart, Sales Representative, Arnold Dryer Company, Corpus Christi

Feeds and Foods for Dehydration, W. G. Hugly, Director of Research, Southwestern Settlement and Development Corporation, Houston

Fuels Used for Individual Farm Hay and Grain Dryers, J. W. Sorenson, Jr., Division of Agricultural Engineering A & M College, College Station

The Economics and Construction of Rice and Grain Dryers, M. R. *Van Valkenburgh,* Consulting Engineer, Houston

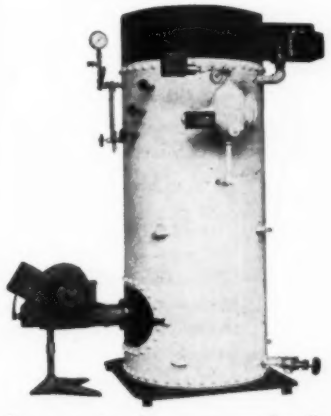
Heat Control for Dehydration, F. C. Brandt, Minneapolis-Honeywell Regulator Co., Houston

Experiences in the Dehydration of Cereal Grasses and Other Farm Products, W. A. Hardin, Manager, Evergreen Farms, Raymondville, Texas

Open Forum on Dehydration — Joint meeting with the section on Natural Gas Transmission, R. M. Hutchinson, Director of Research, Houston Natural Gas Corporation, Houston, Texas, Presiding.

All persons attending were invited to Humble Camp for a Texas style barbecue given by the Chamber of Commerce of Kingsville, Texas, and for inspection trip to the King Ranch, the largest ranch in the world, to see the prize cattle and horses.

LATTNER
GAS — OIL BOILER
3 HP to 35 HP.



Burns natural gas or regular furnace oils with equal efficiency using same burner.

P. M. Lattner Mfg. Company
Cedar Rapids, Iowa

New Equipment and Appliances

New Space Heater

A new free-standing gas fired home heater—manufactured by Hot Boy, Inc., a subsidiary of the Coroaire Heater Corporation of Cleveland 15, Ohio, has been announced.

Hot Boy Heater

The new Hot Boy has a brazed steel heat exchanger, a sixteen inch slow-speed fan, a down-draft diverter and an air filter. Company engineers say that the Hot Boy will heat three to six rooms—supplying quick clean heat to the entire space in a matter of minutes.

Descriptive bulletin gives complete details of this Console Model 60.

New Appliance Regulators

Pittsburgh Equitable Meter Division of Rockwell Manufacturing Company has introduced a complete new series of appliance burner pressure single valve regulators. Designated as Rockwell-Emco Appliance Regulators, this line is available in sizes from ⅛" through 1¼".

The bodies and covers of these regulators are pressure cast from a special aluminum alloy that weighs only one-third as much as iron. This material is non-corrosive and durable. The smooth exterior surfaces are attractively finished with a protective coating of neutral grey lacquer. With their eye-pleasing proportions and finish, they nautrally harmonize and blend into modern gas appliances. Their light weight

Rockwell-Emco Regulator

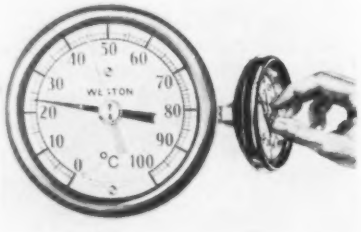
makes possible marked savings in shipping costs and is also apparent in ease of handling.

Attractive exterior contours have been matched with functionally streamlined interior flow passages. Areaways are large and smooth walled to hold pressure absorption to a minimum. Valves and seats are of generous proportions. All sizes reflect a careful study that has resulted in the use of standardized proportions for diaphragm, valve chamber and interior passageways with respect to pipe size, pressure drop and capacity requirements. For additional information write Pittsburgh Equitable Meter Division, Rockwell Manufacturing Company, Pittsburgh 8, Pa.

New Weston Thermometer

A new all-metal thermometer known as the Max-Min, which indicates the maximum or minimum temperatures reached, has been introduced by the Weston Electrical Instrument Corporation, Newark, N. J.

Similar in other respects to the standard Weston all-metal thermometer, it has an auxiliary red index which is manually set by a finger knob as shown.



Max-Min Temperature Indicator

When a record of lowest or highest temperature is desired, this index is placed to the low or high side of the temperature pointer. The pointer will move the index to the extreme temperature reached during any operating period, and the index remains at that point until manually re-set.

Now available in two models, with scale diameters of three and five inches respectively and in all the usual Weston ranges. Stem lengths are from two and one-half to 48 inches.

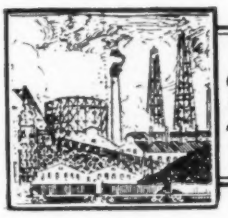
This thermometer will provide an accurate record of high or low temperatures, such as on sterilizers, ovens, industrial equipment and in many processing operations throughout industry. Bulletin on request.

Bendix Clothes Dryer

The Bendix gas fired clothes dryer is built to the following specifications: Capacity, 18 pounds of wet clothes, bone dry in 45 minutes; operating speed, 50 revolutions per minute; motor, 1/6 horsepower, 110 volt a. c.; dimensions, 36 inches high, 31 inches wide, 25 inches deep; weight, 250 pounds; finish, white, hard-baked enamel.

Gas Fired Clothes Dryer

The gas heater operates on 22,000 B.T.U. of gas. At the back of the dryer there is provision for a 3-inch pipe connection to exhaust gas fumes outdoors where necessary. The center of the hole is located 33¼ inches from the bottom and 3½ inches from the right side. Cost of operation is estimated at 1 to 2 cents a load.



News of the Gas Industry

New "CP" Requirements for Automatic Gas Ranges

New requirements for automatic gas ranges built to "CP" standards which are created to give the homemaker better cooking performance have been announced by E. Carl Sorby, Vice-President, Geo. D. Roper Corporation and Chairman of the "CP" Manufacturers Group of the Gas Appliance Manufacturers Association.

The new "CP" requirements go into effect January 1, 1947 when, the gas range production rate is expected to exceed by at least 50% the 2,300,000 ranges sold in 1941. Evidence that this production rate can be sold, according to Mr. Sorby, are the millions of new homes that will be built, the 12,540,000 gas ranges in homes that are more than ten years old and need replacement, and the 1,442,500 gain in residential gas customers since 1941, which brings the total number of homes now using gas for cooking in the U. S. and Canada to 20,750,000.

First requirement for gas ranges bearing the "CP" trademark is that they meet the new more stringent American Gas Association testing laboratories' Blue Star requirements. Other "CP" requirements are aimed at giving the housewife a new and more completely automatic cooking service, savings in food, fuel and time, and better cooking results.

All burners, including ovens and broilers, light automatically; ovens are required to preheat quickly, reach high temperatures fast and automatically, maintain temperatures down to 250 degrees; drawers must be quiet operating without undue friction or jamming; effective stops must be provided to prevent tilting and spillage of oven racks; broilers must be smokeless and provide effective broiling over 80% of the broiler area; more efficient, rust-proof top burners that instantly give all cooking heats from high for quick cooking to simmer for minimum water, vitamin and mineral saving cooking. One top burner must be of a "giant" or oversized type. Among other requirements are efficiency and burner speed, flush-to-wall construction, oven thermostats, venting away from walls, coolness of outside oven and broiler walls and top surfaces.

Among the optional features which will give the homemaker the widest variety of convenience and performance features available in any cooking appliance for any fuel according to G.A.M.A., are "automatic" clock controls to turn cooking on and off, 4, 6 or 8 top burners in a variety of arrangements, two ovens, high or low broilers, built-in griddles and deep well cookers, deep barbecue broilers that serve as a second oven, "Serve hot" grills, food crisping bins, built-in cooking charts, one-piece top construction, warming closets, towel dryers, glass oven doors, lights in ovens and broilers, swingout broilers, removable oven linings for easier cleaning, radiant broilers, minute minders, incinerator compartments, kitchen heaters, utility storage drawers, and 4-hour oven shut-offs.

The NEGA Home Service Development Conference

A 2-day Home Service Development Conference will be held in Boston on October 24 and 25 by the Home Service Educational Committee, Home Service Group, Sales Division of The New England Gas Association.

Program planning has been under way for some weeks under the direction of Mrs. Lillian P. Dunbar of Cambridge, Chairman of the Committee, immediate past Chairman of the Group, and current A.G.A. Home Service Chairman. Miss Susan A. Mack of Boston, Chairman of the NEGA Home Service Group, is cooperating with Mrs. Dunbar in developing the conference program.

The first session will feature "New Viewpoints" which will be the product of a group of home service representatives who have become associated with the gas industry during the past year and who are thus expected to emphasize an outside viewpoint. The effort will be made to introduce a fresh approach to customer relations. Among other items at this session will be one entitled "What Do We Lack That We Should Have?" Another feature will be a quiz contest to develop as many new ideas as possible.

The second of the 4 sessions will present youth classes, brides' classes, employees' classes, men's classes, planning modern kitchens for home making instruction, and participation by home service representatives in the activities of service and professional groups in their community.

The third session will present the increasing consumer interest in home laundry mechanics and discussions on frozen foods, pressure saucepans, and other new developments of interest to home service representatives.

The fourth session will offer an address by a gas industry executive on "What Management Expects Of Home Service." There will also be several sales promotion presentations covering recent developments of interest in this field.

Norman Millard, Superintendent, Domestic Sales Division, Boston Consolidated Gas Company, will be the chairman of the committee handling various exhibits in the company's auditorium where the conference will be held.

CONVENTION CALENDAR

October

7-11 *American Gas Association*, Annual Meeting, Atlantic City, N. J., Convention and Exhibition.

7-11 *National Safety Congress* and Exposition, Stevens Hotel, Chicago.

24 *New England Gas Assn.* Operating Division, Springfield, Mass.

24-25 *N.E.G.A.*, Home Service Development Conference, Boston.

28-30 *Midwest Gas Assn* and Iowa State College Gas School and Conference, Ames, Iowa.

November

11-14 *National Hotel Exposition*, Grand Central Palace, New York.

18-22 *National Metal Congress* and Exposition, Atlantic City, N. J.

20 *N.E.G.A.*, Safety Conference of Operating Division, Worcester, Mass.

21-22 *Mid-Southeastern Gas Assn.*, Raleigh, N. C.

22-23 *New Jersey Utilities Assn.*, Seaview Country Club, Absecon, N. J.

December

2-6 *Amer. Soc. Mechanical Engineers*, New York.

2-6 *National Exposition*, Power and Mech. Eng'g., Grand Central Palace, New York.

1947

March

20-21 *New England Gas Association*, Annual Meeting, Boston, Mass.

W. E. Caine Appointed Secretary Accounting Section A.G.A.

Appointment of Walter E. Caine as secretary of the Accounting Section of the American Gas Association, has been announced by H. Carl Wolf, managing director, effective October 15. He will succeed O. W. Brewer, past-secretary of the Section, who will devote his time entirely to the increasing duties of auditor and supervision of the Association's accounting staff.

Mr. Caine will continue to head the Bureau of Statistics. His title will be director of Bureau of Statistics, and in addition, secretary, Accounting Section.

Plumbing and Gas Appliance Installation Code in Pacific Area To Be Amended

In accordance with its announced policy of annually revising the uniform plumbing and gas installation code adopted at its 1945 convention in Los Angeles, the Western Plumbing Officials Association is taking action on a series of proposed changes in the present code provisions pertaining to gas fittings and piping, water heaters and gas fire places, covered in Sections 1501 to 1526.

The revisions concern soil, waste and vent pipes, gas outlets in fire places, diameter of gas pipe and size of water heater recesses.

The San Gabriel Valley Merchant Plumbers' Association advised the Code Revision Committee headed by W. L. Hallberg of Huntington Park, Calif., that, in its opinion, the present code requirements for a 12-square foot compartment for gas water heaters increases rather than decreases the fire hazard.

The plumbing group, through its President, Don H. Walling, pointed out that 12 square feet of floor area results in a compartment about 3x4 feet in dimension. A chamber of that size, the plumbing association declared, is an invitation to storing oily dust cloths, mops, brooms and other household cleaning appurtenances that cause a fire hazard when stored in a small compartment.

The recommendation proposed that the word "compartment" be eliminated from the code and that the code be amended to require that gas water heaters may be installed in a doorless recess of at least 8 square feet interior floor area.

The following new paragraph has been prepared for insertion in Section 1517:

"Gas outlets in fireplaces shall not be over eight inches from front or more than six inches from side or less than two inches from the finished surface of such fireplace. Operating valves controlling such outlets shall be in the same room and not over four feet from such outlets."

Section 1513 has been recommended for amendment to provide that gas water heaters burning not more than 90 C.F.H. may be connected with copper tubing, using compression joints, providing the tubing conforms to the following requirements:

"1. . . Such tubing shall be soft annealed, have an inside diameter of not less than ¾ inch and have a wall thickness of not less than .035 inch.

2 . . . The overall length of such tubing shall not exceed six feet.

3 . . . A stopcock shall be installed at the point said tubing connects to the housepiping.

4 . . . The method of attaching tubing to the housepiping and the appliance shall not depend upon separate ferrules, washers, gaskets, or other detachable parts for gas tightness, nor shall such separate parts be used to establish and maintain the methods of seal provided within the tubings and fittings.

5 . . . No part of such tubing shall be concealed within, or run through any wall or partition.

A proposed change in Section 15 provides that all gas pipe of 2 inch or less diameter, installed below ground, and/or embedded in concrete or pavement in any building or between building and meter location, shall be of copper or red brass, with zinc content not more than 15%, and, if assembled by means of soldered joints, shall be of Type K or heavier, as specified in Federal Spec. WW-T-799, entitled "Tubing, Copper, Seamless."

Other proposed changes in the pipe regulations provide:

That copper or red brass piping must be terminated so that the connection to ferrous pipe will be permanently out of contact with soil or concrete.

That where copper or red brass pipe is used as described above, any one of the following methods of jointing may be used:

Brazing, in which case the brazing material shall be a copper alloy containing not more than 15% zinc.

Soldering, using bronze or copper solder-type fittings and solder having approximately the following compositon, 15% silver, 5% flux.

Proposed changes in Section 1517 provide that all gas pipe shall be graded toward the meter wherever possible; and that piping trapped by a change of grade shall be provided with a suitable drip pipe at the points where condensation will tend to collect. The drip pipe shall be of the same diameter as the pipe to which it is attached and shall be at least six inches long.

Another proposed change provides that all gas piping must be supported, at intervals of not more than six feet, by straps or hooks capable of withstanding four times the weight of the pipe. Section 1513 is being tightened by a provision that a stopcock shall be installed at the house piping outlet ahead of all gas appliances.

Blue Flame Council Elects Officers

The Blue Flame Merchandising Council of Dallas, made up of gas appliance manufacturers' representatives and sales executives of gas utility companies, celebrated its first anniversary at a dinner by re-electing the following officers: President, Fred D. Bradley, Southern Union Gas Co.; Vice-President, Carl Trevitt, Lone Star Gas Co.; Secretary-Treasurer, Jim B. Reese, Lone Star Gas Co. Directors elected are; Seward Abbott, Servel, Inc.; Leon Conner, Athens Stove Co.; W. W. Hall, General Gas Light Co.; J. W. Martin, L. P. G. Equipment Corp. Chairman of committees are: Program, Carl Trevitt, Lone Star Gas Co.; Publicity, J. M. Lynn, Jr., Lone Star Gas Co.; Membership, J. H. Schmidt, Peerless Mfg. Co.; Attendance, W. W. Hall, General Gas Light Co.

This Council was organized in July, 1945. The objectives are to exchange ideas in connection with the merchandising of gas appliances; to collect and disseminate information of benefit to its members regarding various phases of gas appliance merchandising; to promote acquaintance, good fellowship and closer business relationship between persons identified with the Council. Luncheons and meetings are held the first and third Mondays of each month.

New Standards Approved

Addenda to American Standard Approval Requirements for Hotel and Restaurant Ranges and Unit Broilers and for Hotel and Restaurant Deep Fat Fryers, consisting chiefly of additions to cover approval under conditions of high altitude, have been submitted to the American Standards Association for approval as American Standard.

Adopted by the A.G.A. Approval Requirements Committee, they go to the A.S.A. Board of Examination for recommendation to the Standards Council on Approval.

SUPERIOR GAS METERS

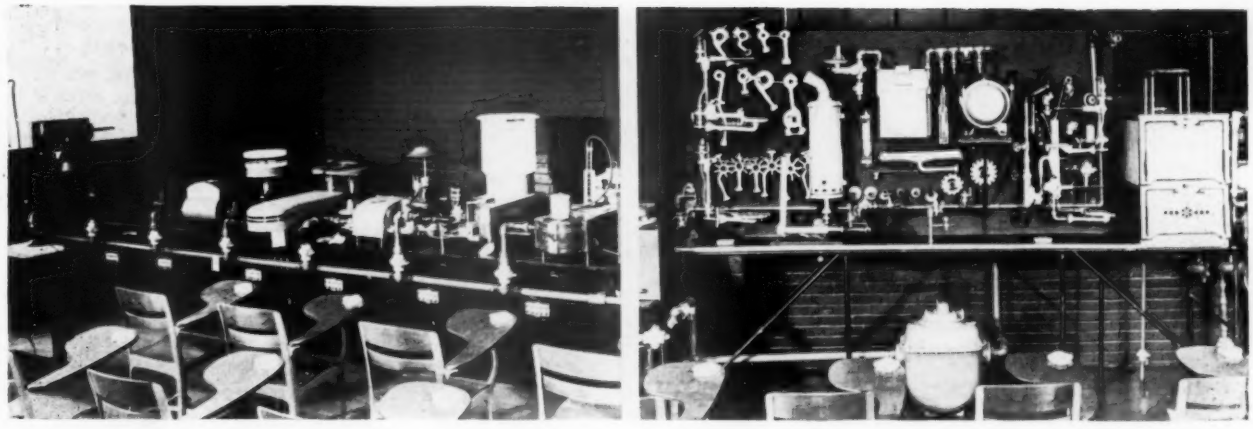
For Sound Values and Continuous Operating Economy

Meters for Domestic and Industrial Use. All Sizes 5B to 60C.
Wet Test and Demonstration Meters — Diaphragms —
Service Cleaners — Provers — Meter Repairs

Write for details and quotations

SUPERIOR METER COMPANY, INC.

167 41st Street Brooklyn, N. Y.



On the left, demonstration for conversion burners. On the right, appliance demonstration.

Illinois Power Company Installs Gas Testing Laboratory

In their desire to co-operate with gas appliance dealers and to bring their own personnel up-to-date with regard to the installing, servicing and maintaining the many new gas burning appliances now being manufactured and marketed, the management of the Illinois Power Company recently authorized the installation of a modern gas testing laboratory at Granite City, Illinois.

The laboratory was designed and installed under the supervision of M. J. Westenhaver, assisted by E. G. Schmitt, Granite City Manager of the company and John Miller, a gas man with many years of experience.

The laboratory is equipped with all types of approved A.G.A. burners (range, water heater, conversion and industrial) and auxilary equipment including meters, pressure gauges, and a calorimeter, together with such other apparatus necessary for making a complete and exhaustive test of all gas burning appliances from a single burner hot plate to a gas furnace.

These courses are for I. P. Co. sales and servicemen, dealers and the personnel of dealers. The course aside from instruction in the proper methods of installation, adjustment of all types of equipment, and the most modern methods of figuring operating cost will also deal with good customer relations, a phase of good public service that the management heartily endorses.

Goss Elected President Chattanooga Gas Co.

A. J. Goss, formerly vice-president and general manager of the Chattanooga Gas Company, has been elevated to the company's presidency.

At the same time it was revealed that H. R. Derrick of Birmingham was elected as vice-president in charge of operations to succeed Goss in his former post.

A. J. Goss H. R. Derrick

Mr. Goss announced that E. G. Petering will continue as secretary-treasurer of the Chattanooga Gas Co. and that W. M. Wampler will continue as assistant secretary-treasurer. There will be no changes in policies or personnel other than the three listed.

Mr. Goss came to Chattanooga in March, 1923, as general manager of the gas company and was elected vice-president in 1928. Until his recent promotion he had served as vice-president and general manager.

Mr. Goss was honored by members of the company's organization at a surprise party Sept. 16th on the occasion of the 50th anniversary of his entrance into the gas industry.

At the close of the day's business, employees assembled in the utility's cafeteria, after Goss had been told the meeting had been arranged to give him an opportunity to introduce H. R. Derrick, new vice-president and general manager.

The real reason, however, was to express congratulations and present him with a silver meat platter and a huge anniversary cake. Early in the day the gas company head had been presented a bouquet of 50 roses by the employees

The platter presentation was made by Mr. Derrick, who assumed his duties with the company Sept. 1.

Simplex Valve and Meter Co. Acquired by Permutit Co.

The Permutit Company, manufacturers of power plant specialties, has acquired the Simplex Valve and Meter Company of Philadelphia, according to an announcement made by H. W. Foulds, Permutit President.

CRUSE-KEMPER COMPANY
AMBLER, PENNA.
GAS HOLDERS
Low Pressure High Pressure Inspection
Purifiers Tanks Flues
Over 40 Years of Sound
Steel Plate Construction

Illinois Institute of Technology

Illinois Institute of Technology began the first semester of the 1946-47 academic year on September 23, with peak enrollment of nearly 7,000 students and an all-time record budget of over 5 million dollars.

This year will mark the 50th year that Lewis Institute, which combined with Armour Institute in 1940 to form Illinois Institute of Technology, has been in continuous operation. The golden jubilee for the Lewis division is also the tenth anniversary for Illinois Tech's famed Armour Research Foundation which started in 1936 with a $30,000 budget and last year passed the $2,000,000 mark in budget figures.

At the Institute of Gas Technology at Illinois Tech the educational program for graduate students is again in full swing after having been discontinued during the war. This year nine fellowships have been granted to students from all sections of the country to work for advanced degrees in the field of gas technology. Major emphasis is being placed on the four-year term for the doctorate.

Ruthenburg Succeeds Sarnoff

Louis Ruthenburg, president of Servel, Inc., Evansville, Indiana, has been appointed to the Labor-Management Advisory Committee of the United States' Conciliation Service.

Mr. Ruthenburg was selected by the United States Chamber of Commerce to succeed David Sarnoff, president of the Radio Corporation of America, who resigned.

Announcement of the appointment of Servel's president was made by Edgar L. Warren, director of the United States Conciliation Service.

Mr. Warren also announced the appointment of Richard T. Leonard, vice-president of the C.I.O. United Auto Workers, who succeeded Richard T. Frankensteen as a C.I.O. member.

Information Clearing House

A library research service of special interest to industrial and scientific organizations not having ready access to the wealth of scientific literature in New York City is now offered by the Technical Library Consultants, 347 Madison Avenue. The service is specifically designed to meet the literature research needs of executive, sales and research departments.

Specialists on the staff have been serving industry for years in the installation of complete special libraries, technical indexing of organization reports and finding the answer to all research problems so far as the literature and patents in most European languages can supply it.

Oklahoma Utilities Assn. Holds One Day Meeting

The Gas Division of the Oklahoma Utilities Assn., held a one day conference in Oklahoma City, September 20th, C. B. Day, District Manager, Consolidated Gas Utilities Corp., Blackwell, Okla., was chairman.

Papers presented covered many subjects, including "Customer Accounting," by John Turner, Jr., "Importance of Better Customer Service and How to Accomplish It" by D. E. Friedan, "Promoting Better House Piping," by E. C. McAninch, "Dealer Cooperation Through Home Service Department" by Don Warner and "What's New in Gas Appliances" by Eugene D. Milener, Coordinator of General Research, A.G.A.

New Public Relations Company

The formation of a new firm which will include as one of its specialties the study of public relations problems in privately-owned public utilities has been announced in St. Louis, Mo., located at 3607 Olive Street.

"We have placed particular emphasis on the public utility field," said Alfred Fleishman, St. Louis civic administrator and community affairs leader, who heads the organization of Fleishman, Hillard & Associates, "because of the growing number of public relations problems facing all utilities now under private control."

The new St. Louis firm will be headed by Fleishman and Robert E. Hillard, former feature editor and columnist on the St. Louis Star-Times. Their services will include over-all public relations research and planning.

Dow Chemical Company Staff Appointments

Howard P. Atkin, after four years service with the Army Air Corps, recently became a member of the Cathodic Protection Sales staff of The Dow Chemical Company, working in the Los Angeles, California, office. Atkin is a graduate in chemical engineering of the University of Southern California.

Ray H. McLeod, a graduate chemical engineer from Northwestern University, has also joined the staff following his release from the Navy. Mr. McLeod is working in the Chicago office.

Bryant Appoints Additional Industrial Representatives

D. A. Campbell, manager of the Industrial Division of Bryant Heater Company, Cleveland, announces the appointment of Homer A. Size and Arthur X. Nelson as representatives of the Division in the application of Bryant gas combustion elements to industrial and process heating equipment.

Mr. Size will represent the division in California and Mr. Nelson, operating Plant Equipment, Inc., will serve the Minneapolis area.

Mr. Size was formerly associated with the Michigan Consolidated Gas Company as Industrial Engineer. For the past two years he has been partner and manager of Immersion Heating Equipment Company of Los Angeles, which association he will continue, in addition to serving as Bryant representative, at 2143 W. Washington Boulevard, Los Angeles 7, California.

A native of Minnesota, Mr. Nelson has just completed three years with the Navy and previous to that time was associated with the Minneapolis Gas Light Company as Industrial Engineer. Plant Equipment, Inc., is located at 1104 Baker Building, Minneapolis 2, Minn.

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A. S. A. Honors Laboratories

Honoring the work of the American Gas Association Testing Laboratories in the development of standards for Army and Navy equipment and procedure, R. M. Conner, Director, recently was awarded a certificate of recognition by the American Standards Association.

As a member of the war committee of the association, Mr. Conner attended an award dinner at the Officer's Club of the Brooklyn Naval Yard on August 14th, at which time the certificate was presented.

Speakers were Rear Admiral F. E. Haeberle, Commander, New York Naval Shipyard; Rear Admiral Charles A. Dunn, Supervisor Inspector, Naval Materiel; Brig. General Donald N. Armstrong, former commandant of the Industrial College of the armed forces; Henry B. Bryans, President, American Standards Association; and Howard Coonley, Chairman, Executive Committee of the A.S.A.

The association and its war committee members were honored for aiding in the simplification of products, promoting interchangeability of repair parts, and sponsoring better procedures and higher standards of manufacture through war standards, which resulted in the savings of time, money and material and greatly contributed to the Allied victory.

Bryant Heater Co. Adds to New York Sales Staff

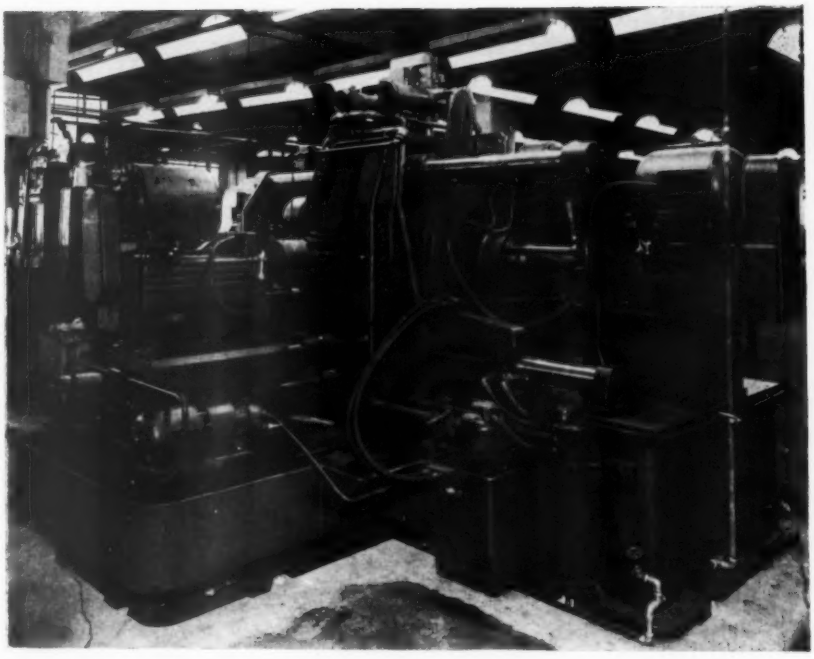
James Crawford, sales manager of The Bryant Heater Company, Cleveland, announces the appointment of Malcolm McLean and Raymond A. Bissell as district representatives of the company in the New York area.

Working with M. H. Laundon, Jr., Bryant branch manager, the two men will extend Bryant's services in the area in the application of the company's varied line of gas-fired heating equipment.

McLean, a resident of New Rochelle, was previously connected with the Westchester Lighting Company.

A graduate of Lafayette College, Bissell was for 14 years district house heating supervisor of the Brooklyn Union Gas Company.

The Bryant Heater Company's New York offices are in the Chanin Bldg., 122 East 42nd Street.



That all-American bottleneck—retarded production—was thrown for a sizeable loss at the Robertshaw Thermostat Company's plant at Youngwood, Pennsylvania, recently with the installation of the above single-purpose machine, which turns out BJ thermostats in rapid-fire order. Range manufacturers and appliance dealers will be glad to know that output of Robertshaw Thermostats will be greatly increased by the many features of the new machine, which weighs 16 tons, performs 52 operations and has a manpower ratio of 64 to 1.

Miss Armstrong Appointed on Servel Staff

Miss Janet Armstrong has joined the staff of the Homemaker's Institute at Servel as assistant director of home economics research.

Miss Armstrong comes from Purdue University where she has been working with University staff members on a household research problem for Life magazine. Results of the study, which concerned work simplification of household tasks, were published recently in Life. She received her B.S. in home economics from Purdue University in June, 1944.

Paul Grimes to Represent Blodgett

Mr. Paul C. Grimes, formerly New England representative prior to his Army service has been appointed mid-western representative for Blodgett Baking and Roasting Ovens, and will cover the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa and the cities of St. Louis, Missouri and Pittsburgh, Pennsylvania, with headquarters in Chicago, it was announced by the G. S. Blodgett Co., Inc., of Burlington, Vermont. Mr. Grimes, for five years prior to the war, covered the New England states for the company.

CLEVELAND

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"B" TYPE METERS
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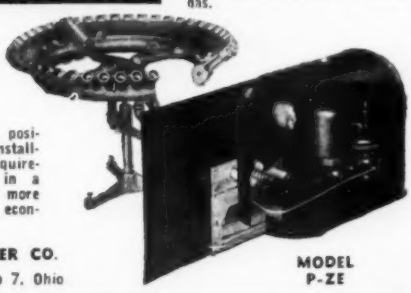
NU-TYPE ductless burner that performs perfectly with natural, manufactured or mixed gas.

Popular with scores of utilities and thousands of home owners. Simplifies problem of converting to gas Tamperproof controls, quiet operation, high efficiency, positive performance. Easily installed. Negligible service requirements. Each installation in a neighborhood sells many more because of its simplicity, economy and ease of control.



COLUMBIA BURNER CO.
729 Ewing St., Toledo 7, Ohio

MODEL P-ZE

Cast Iron Distribution Line Extension at Hartford, Conn.

The Hartford Gas Company laid some 25,000 feet of 4-inch and 6-inch U. S. Standardized Mechanical Joint Pipe to bring gas service to four housing projects in the nearby Town of Manchester and other groups of houses situated along the newly extended mains.

These lines were laid by a contractor who used a crew of six men, a back-hoe and pay loader. The pipe was tested in sections as it was laid. While under an air test pressure of 25 psi. soapy water was brushed on and around each joint. A Gas Company inspector carefully checked each joint to see that it was tight. This crew laid an average of 500 feet per day, which included trenching, installing and testing the pipe, and backfilling the trench.

Although the load brought about by this installation was not added until after the war, The Hartford Gas Company did experience increased demand for its service during the war period. For the period January, 1941, to December, 1945, the number of customers rose from 56,000 to 61,100 and the yearly output increased from 2,448,000 MCF to 3,207,000 MCF. The nature of the load is approximately 70% residential, 15% commercial and 15% industrial.

The Hartford Gas Company system, which includes 410 miles of cast iron pipe, serves the communities of Bloomfield, East Hartford, Glastonbury, Hartford, Manchester, West Hartford, and Wethersfield. This territory covers about 75 square miles and has a population of approximately 320,000.

Included in that 410 miles of pipe is a 10-inch cast iron line on Main Street, Hartford, that has been faithfully serving since its installation in 1849—ninety-seven years ago.

Labor-Management Relations Amer. Stove, Cleveland Plant

Based on good common sense all around —the brand of good judgment that made Cleveland's wartime labor record one of the nation's best—American Stove is one of the many companies that is extending that record into its peacetime system.

Neither labor nor management at American Stove claims to have anything particularly extraordinary in its handling of labor problems. They do confess to a mutual respect and trust, and have proven their ability to settle little differences before they become big differences.

Quick handling of minor grievances is a keynote. If a committeeman gets a gripe —and there are plenty—he and the worker go immediately to the foreman.

If it can't be settled on the spot, it goes —the same day—to the personnel manager. The plant manager sits in if necessary. There's no dead time for grievances to accumulate.

Both have another principle they feel is fundamental. Grievances and contract negotiations are settled within the plant.

There are other factors in the current labor-management picture at American Stove. They include such things as the firm company policy of filling higher-pay jobs from the lower brackets, which has led, in the long pull, to the steady advancement that discourages rapid turnover.

They include such things as a policy described as completely sound by both union and management on handling of returning and newly-hired veterans.

But basically, it is the determination of both groups to solve their own problems, without outside help, on the spot, that is making the American Stove labor relations policy work.

San Francisco Recommended for A.G.A. Convention in 1947

The Time and Place Committee of the American Gas Association, of which Nils T. Sellman, Vice-President, Westchester Lighting Company, is chairman, informed the Executive Board of the Association at its meeting on September 11, of its intention to recommend to the Atlantic City Convention that the 1947 Convention of the American Gas Association be held in San Francisco, Calif., from September 29 to October 3, 1947.

Approval of the recommendation by the Convention is required, but subject to such approval by the membership of the Association, tentative arrangements have been made to convene in San Francisco next year.

Bernhardt with Grand Home Appliance Co.

Stanley C. Bernhardt has been elected Vice-President and Sales Manager of the Grand Home Appliance Company, division of the Cleveland Cooperative Stove Company, Cleveland, Ohio.

Mr. Bernhardt, formerly Vice-President in Charge of Sales of the Estate Stove Company, Hamilton, Ohio, with which company he was associated for sixteen years, will succeed Mr. A. B. Cameron, who recently resigned.

GILBERT E. SEIL

Dr. Gilbert E. Seil, fifty-seven, chemist and metallurgist, died September 11th following an operation two weeks previously. Dr. Seil was Technical director of E. J. Lavino & Co., 1528 Walnut Street. In 1940 he was appointed a member of the technologic committee on manganese which the National Research Council of the National Academy of Science formed at the request of the Council of National Defense. A native of Brooklyn, he was educated at Rutgers University and Columbia.

Gas Pulsation

(Continued from page 42)

On the suction side of compressors the installation of dampeners results in a uniform pressure condition at the time the suction valve is open. This prevents the previously mentioned condition of starvation one instance, and a super-charged condition the next instance, and results in a uniform suction pressure condition.

One other factor in plant design is worthy of mention and that is the fact that all piping and equipment may be sized for steady flow if dampeners are to be installed, thereby eliminating the effect of oversizing for pulse peak velocities.

THE GOODMAN STOPPER

Now has the "Z" handle for easy manipulation. When locked in place it holds. Stopper cannot slip. Gas cannot pass. Adjusted in 30 seconds.

Ask for circulars on this and other distribution equipment.

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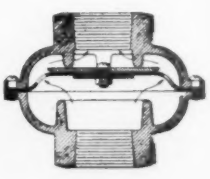

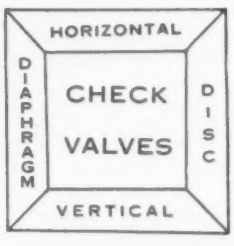

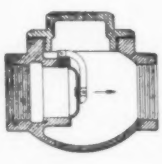

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Copies of bulletins on any of the above available on request, or a summary of their contents in Bulletin 359.

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Length of Pipe—Miles 1-250

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GAS PURIFYING MATERIALS COMPANY, INC.
Long Island City, New York

Liquefied Petroleum Gas

(Continued from page 18)

4. Gas appliance life we all know is indefinite. I sometimes think too indefinite. Electric appliances begin to deteriorate at the first turn of the switch and the dollars spent yearly on maintenance are greatly in excess of those for gas appliances.

LP Gas Supply Future

I have purposely left to the last one subject that I know is uppermost in gas men's minds today, and that is the question of supply.

Transportation today is bad because the LP gas business has grown by leaps and bounds overnight. Tank cars are at a premium and at present almost unobtainable. This will not always be, particularly if the companies now installing LP gas put in ample tank storage so that only normal deliveries are required in the winter.

This transportation situation will be cleared in time, but much assistance can be rendered by proper tank farm design. Eventually water transportation will take care of coastal cities thus releasing tank cars and trucks for interior service.

As to supply of LP gas available now and in the future, there is and will be ample for several times the consumption recorded last year.

The petroleum refineries alone are not up to full capacity. Many of them do not as yet have towers for reclaiming the propanes and butanes.

Then there is the natural gas liquid production which is considerably greater than that of the petroleum refineries. The best evidence of that is to quote from the address of the President of the Natural Gasoline Association of America, Mr. J. H. Dunn, at a recent meeting:

"As natural gasoline went to war there were material increases in the production of propane, butanes, and cycle stocks. These raw materials became important for the manufacture of such products as butadiene, alkylate, cumene, toluene and 100 octane gasoline. The statistics show that for the year 1945, the production of natural gasoline and all related products amounted to a total volume of 111 million barrels." . . .

. . . "Reliable estimates indicate that under present refining practices the potential surplus of butanes from refinery sources alone will, during the next few years, average 50,000 barrels per day. This is over and above the production of our industry. Our problem, therefore, is to find out what can be done with the butanes we fractionate from our natural gasoline and which the refiner normally will not need for volatility. I have already shown how the refining industry collectively will have a potential surplus of volatility the next few years. We can channel our butanes along with propane into expanding LPG markets, and our chances of selling our products to the refiner should be much better if we can offer for his use a butane free gasoline." . . .

. . . "The greatest economic handicaps which natural gasoline has had in the past have been

(1) cost of transportation, and

(2) seasonal demand necessitating expensive periodic storage."

I think, reading between the lines of Mr. Dunn's speech and piecing together facts and figures gleaned from that and other sources, the gas industry need not worry too much about LP gas supply for many years to come, providing—proper tank farm storage is available so that transportation, be it by rail, truck, or water, can be leveled off.

As to LP gas price, that will, of course, fluctuate with other commodities and follow closely crude oil. The potential power wrapped up in these liquids will largely determine their value to our industry.

Leveling out the summer or winter load curve will be the industry's best assurance of a future satisfactory supply at a reasonable cost.

Mechanization

(Continued from page 38)

2. In addition to apparent savings there are hidden savings due to:

(a) Reduction of confusion and indecision on jobs.

(b) Work gets done.

(c) Public relations are better because of stabilization of crews and no lay-offs.

(d) Rainy day losses are less.

(e) Men are happier because their pay rate is higher, and because work is more interesting.

(f) Promotions can be justified because men produce in proportion to their rate. There is consistent pressure in operating Divisions on supervision for promotion whether crews are producing or not because of automatic increases and constant application of employees. A crew can easily advance to a condition of high proportion of high rated personnel whether they are producing or not.

3. Mechanization helps supervision in that after jobs are setup they run themselves and workers proceed without "intent or reflection."

4. Heavy foremen produce. A light foreman who works is much more valuable than a heavy foreman who won't think or organize. The men who can handle your mechanization are among your most valuable employees.

5. The Gas industry in our smaller operating areas is far behind other industries in mechanization. Even the farm industry is very highly mechanized. Material handling industries during the last three years have produced techniques which multiply manpower 30 to 1.

6. Our General Office Departments have rendered valuable services to the utilities in producing standards. Standards multiply supervision many times without effort.

There is no excuse for the absorbing of the time of a very busy heavy foreman in laying out a routine regulator pit which is repeated over and over again in each of the Divisions. Standard drawings of material lists relieve them of the burden.

7. We are very sure that the man who first invented the ditch digger should at the same time have considered backfilling and particularly compacting. The field of implementation has been completely ignored as far as compacting in a trench is concerned. Therefore, the suggestions thrown out in this paper are in the sphere of creation rather than factual reporting. A compactor must be produced soon.

Plans for Future Extension of Mechanization to Other Classes of Jobs

1. We believe that study in the field as suggested above must go on. This is particularly true in these times of stress in which we are attempting to make time. We are proceeding without a study in the basic field processes where the money is actually made.

2. We are sure that in case of Metropolitan or Class I jobs new techniques must be produced. The familiar procedure of tearing a strip of concrete 10" to 14" wide from end to end of town is an unnecessarily expensive and destructive way of laying a conduit which is only 2½" in outside diameter. Therefore we believe that new techniques may go to smaller high pressure conduits cut into the cement in very narrow trenches, perhaps by use of diamond wheels which will remove only the concrete necessary to drop in the small diameter conduits.

Present trenching machines for city work and service laterals are outsize. They are much too big. If the Gas Industry is to stay abreast of other industries in laying mains, we surely must continue original study.

Approved by Underwriters' Laboratories, Inc.

For making both gas and water connections. Takes place of tee, union, and nipple in one fixture. No pipe cutting or threading necessary. The "cutting in" of ordinary tees is sometimes tremendously difficult. With the SKINNER-SEAL Saddle Tee, the job becomes simple and quick—cutting installation costs materially.

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For installing SERVEL ELECTROLUX Refrigerators, BENDIX Home Laundries, heaters, etc.

This item was out of production during the war but we have resumed manufacture and invite correspondance concerning your requirements.

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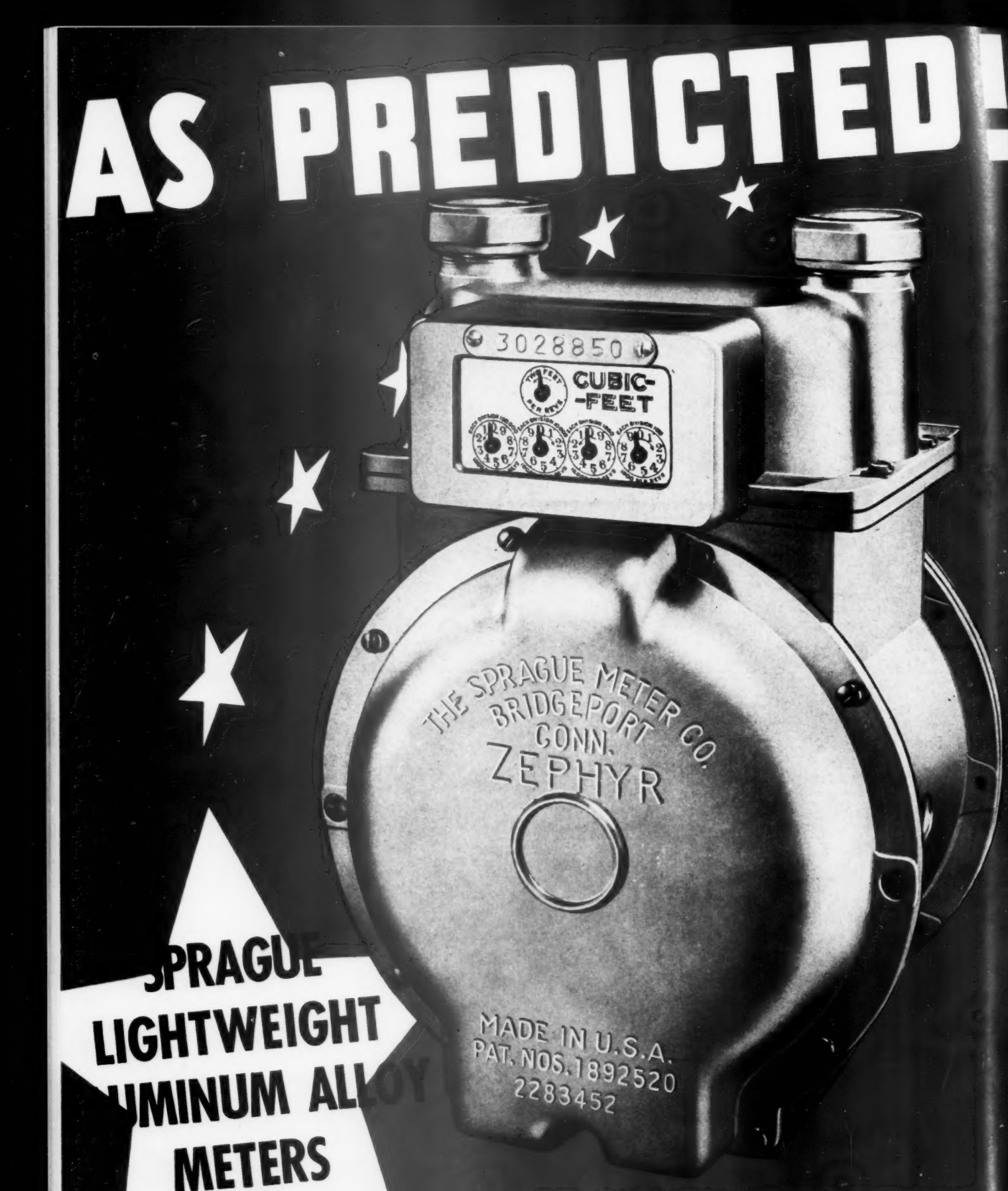
AS PREDICTED!



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